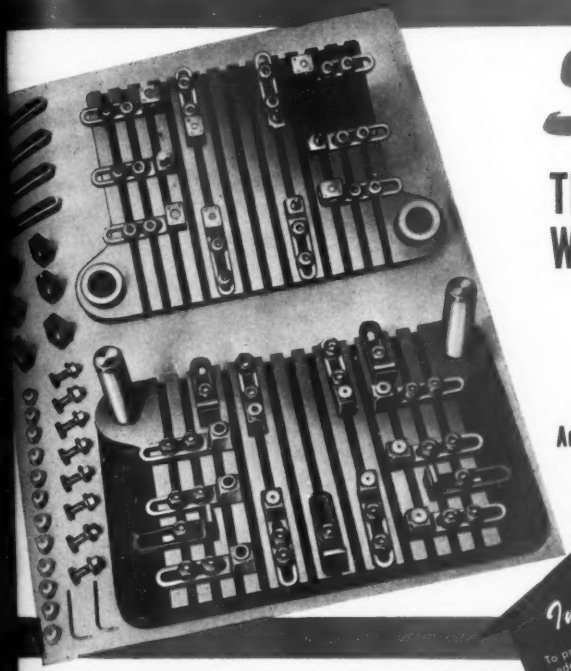
Devoted to: "Tooling America's Production Lines" (See page 55)

APRIL, 1952

The Magazine of

TOOLING and PRODUCTION

TOOL & DIE JOURNAL



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- 12 S-375 Strippers
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Punches and dies are your own selection of sizes from 1/32" up to 3/8" diameters. Everything needed to start production is included.

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The Magazine of

TOOLING and PRODUCTION

TOOL & DIE JOURNAL

1975 Lee Road • CLEVELAND 18, OHIO

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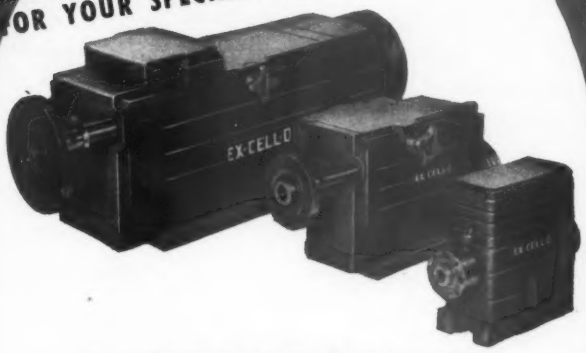

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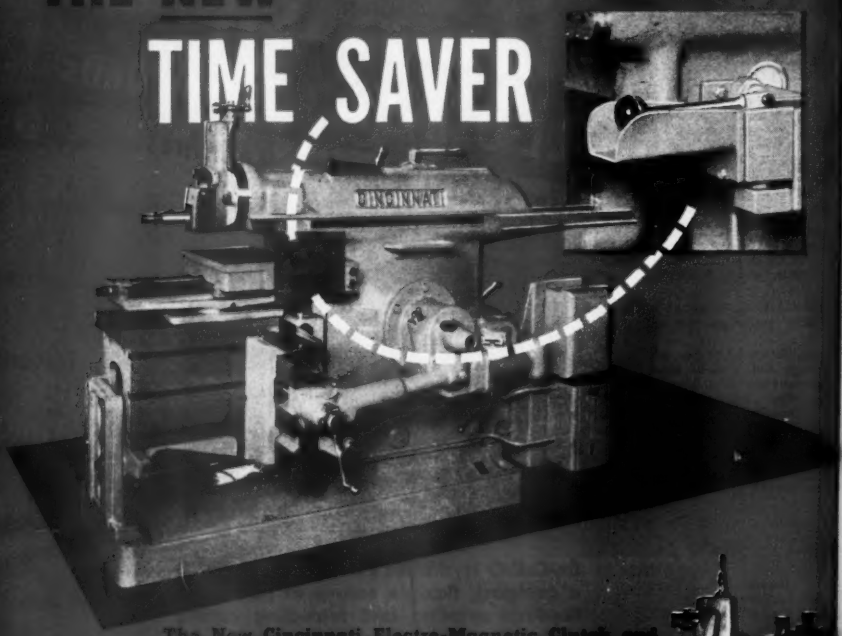
THE NEW TIME SAVER



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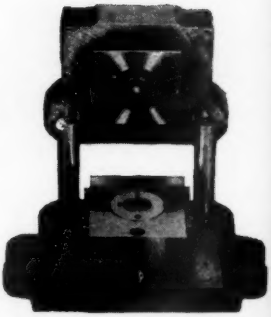

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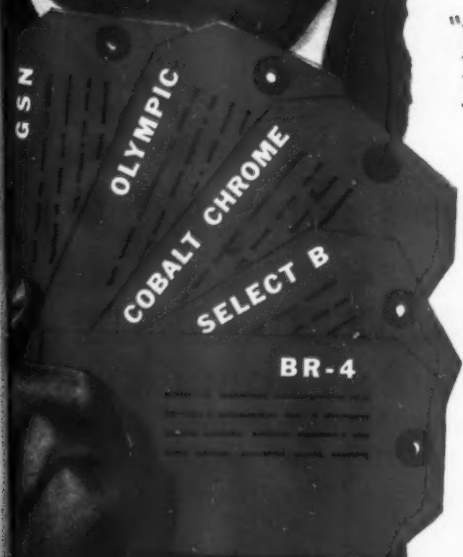

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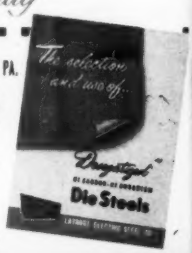

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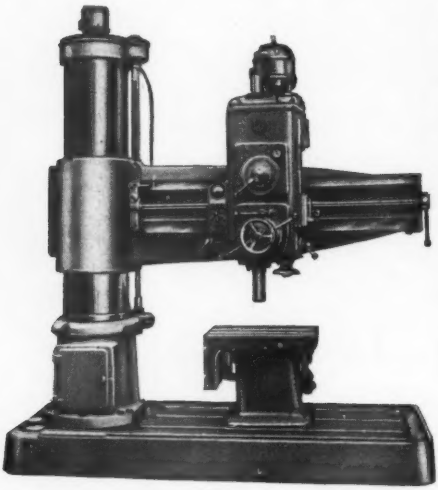

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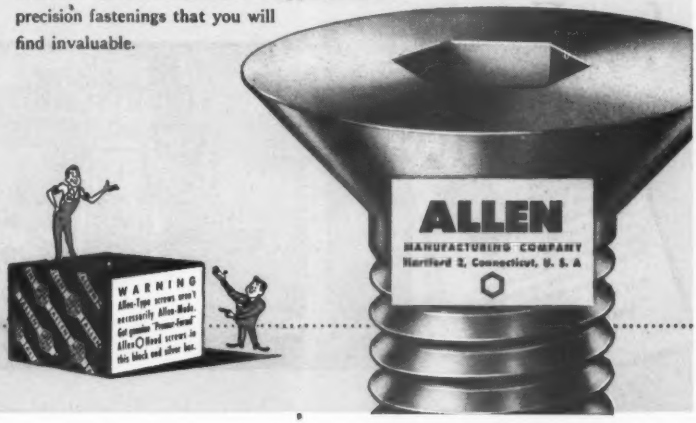

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or Powder...
a BLISS
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for Every
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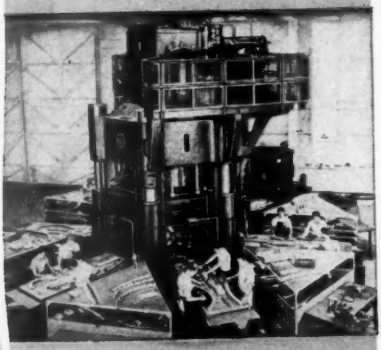

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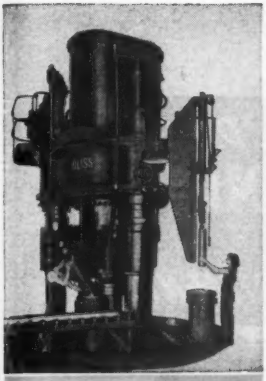

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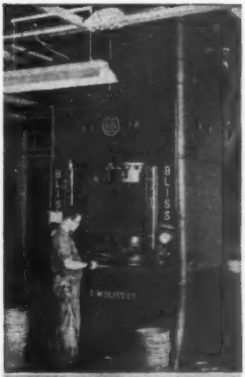

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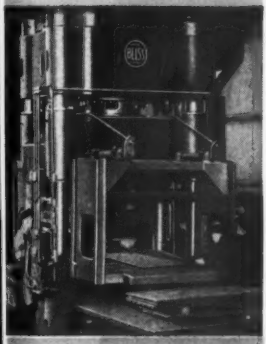

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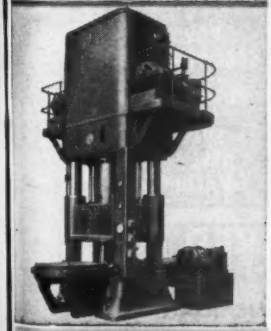

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when they see for themselves

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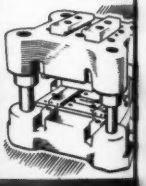

WE'LL TAKE YOU THROUGH so you can see for yourself what Barth has to offer you in what we sincerely believe to be the most completely equipped and staffed plant for designing, engineering and producing top-flight tools, dies, jigs, fixtures, gauges and special machinery available to industry.

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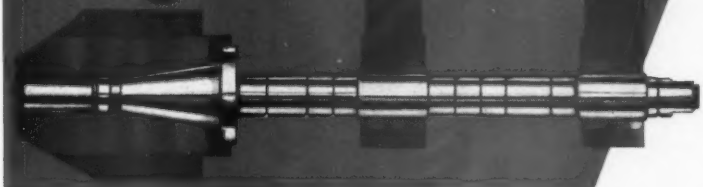
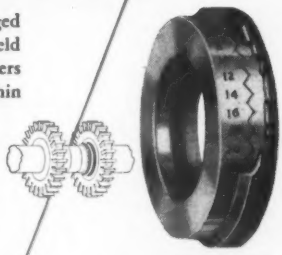


Make heavy or light cuts, fast and accurate, with S-J rugged precision built Arbors. Arbor and pilot diameters held to plus .0000", minus .0005". Arbors filled with spacers and sleeves which have faces ground parallel within .0002"—makes cutters run true and take an even distribution of cutting load.

Low-cost milling machine operations are assured when using S-J Arbors. Built from forgings, they are tough and withstand the punishment required of today's production.



TIME-SAVING S-J ADJUSTABLE SPACING COLLARS

Save valuable time in making accurate adjustments between cutters on gang or straddle milling, and on multiple slotting set-ups.

HIGH PRECISION S-J SOLID SPACING COLLARS

Help assure true-running cutters. Carefully heat treated and faces ground parallel within .0002"

LARGE SELECTION S-J ADAPTERS

Style "C", Shell End Mill Arbor, shown here, is only one of the various S-J Adapters that enables you to convert spindles for driving a variety of tools, such as: end mills, facing mills, keyway cutters.

Write for New Bulletin No. 2-50 showing complete line of S-J Arbors, Collars and Adapters.

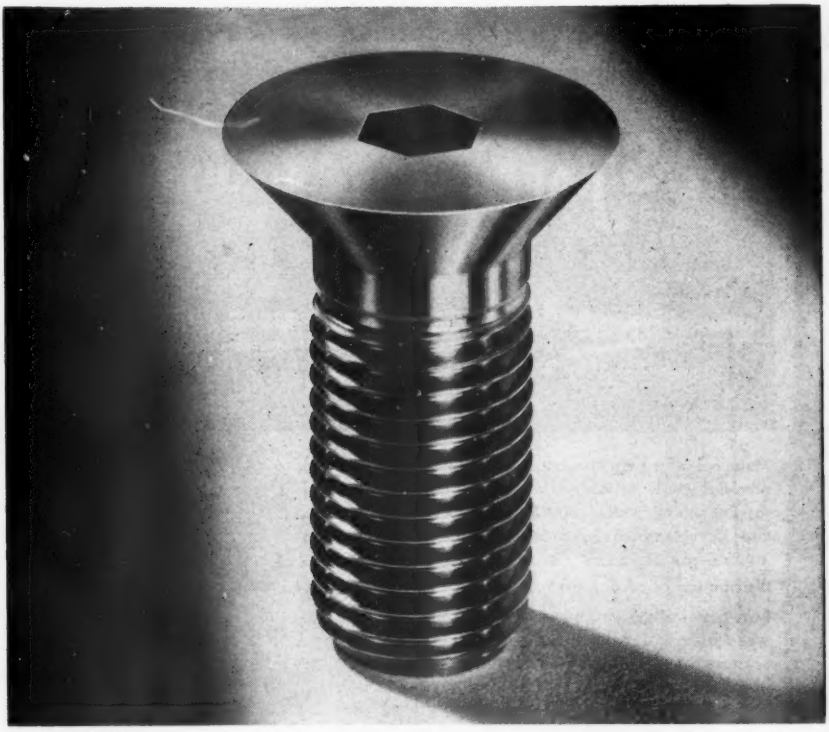
Scully-Jones AND COMPANY

1933 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

RSCSRMM

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS



For assembling THIN-SECTION MATERIALS

UNBRAKO FLAT HEAD SOCKET CAP SCREWS

Precision made to Class 3 fit, these UNBRAKO screws have maximum head contact, flush surface assembly, non-slip internal wrenching, high shear and tensile strength.

Write for descriptive literature.

STANDARD PRESSED STEEL CO., Jenkintown 36, Pennsylvania.

Standard sizes, #4 to ¾" inclusive, are available from your UNBRAKO distributor's stocks. Ask him about deliveries, you'll like what you hear.

UNBRAKO® SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

CAP SCREWS • SET SCREWS • SHOULDER SCREWS • DOWEL PINS • PRESSURE PLUGS

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

2 Duplicators in 1

with TWIN SPINDLES ..a GORTON Tracer-Control Development

Now engineers can plan ahead for stepped-up production with the duplicator they specify today!

Two sets of multiple blades duplicated simultaneously from single master blade on Gorton 9-J.

A Tip to Increase Defense Production

You'll find Gorton Twin-Spindle Duplicators ideal for long production runs of profiling or die and mold cutting operations—both roughing and finishing, in two or three dimensions.

If your present production schedule doesn't warrant twin-spindle operations, install a conventional Gorton Duplicator now. Whenever you feel the need, you can easily change to the twin-spindle head and ram assembly—cost of conversion only 22% of complete single-spindle machine. This doubles the ability of your duplicator to turn out work.

Whether you need a conventional or twin-spindle duplicator, Gorton's general catalog contains important information for you. Write for it.

JOB FACTS

Gorton Super-Speed 9-J Duplicator with twin-spindle head assembly and rotary tables, equipped with two high-speed, 4-flute spiral cutters turning at 980 rpm for both roughing and finishing, profiled from the solid 20 impeller blades 9/16" high by 2" long. Cutting time: 4½ hours. BONUS: One *extra* identical work piece finished completely from one simple master of one blade.

GEORGE GORTON MACHINE CO.

1204 Racine St., Racine, Wis., U. S. A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-1204.

Firm .....

Name .....

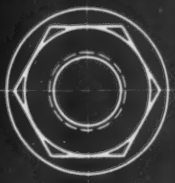
Title .....

Address .....

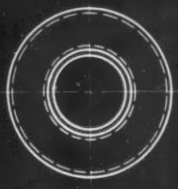
City, State .....

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

KNOB SHOE ASSEMBLY



FLANGE NUTS



SPHERICAL WASHERS

STANDARDIZE

with

WESPO

STANDARD FIXTURE PARTS and FITTINGS

★ ★ ★

The cut shows a few of the 350 parts and fittings which are used by leading manufacturers to save time and money formerly spent in designing and machining.

WESPO parts are precision manufactured of quality steel—heat treated and rust proofed. They are made for heavy duty and long usage and have proved their value in many industries.

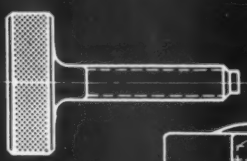
OVER 350 PARTS AVAILABLE

This wide variety of types and sizes makes it easy to use WESPO parts for almost any of your fixture needs. TEMPLATE DRAWINGS OF ALL PARTS ON REQUEST. Write for catalog.

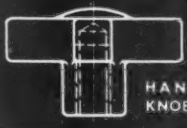
WEST POINT MFG. CO.

26935 West 7 Mile Road

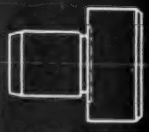
Detroit 19, Michigan



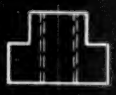
ADJUSTING HEAD SCREWS



HAND KNOBS



REST BUTTONS



T-SLOT NUTS

TEMPLATE DRAWINGS OF ALL PARTS FREE

To get maximum tube life per dollar...Ask the experts!

Pictured above is a direct-reading spectrometer, used in the Timken Company's Spectrographic Laboratory. It chemically analyzes a molten heat of Timken steel in just 40 seconds; makes possible precise control of the steel's properties.

THERE'S only *one* high temperature tube steel that can give you maximum tube life per dollar—the best life/cost ratio—under a particular set of heat, pressure, corrosion and oxidation conditions.

To make sure you get the right steel, go to the metallurgists of The Timken Roller Bearing Company. They're recognized authorities on high temperature steels. With 20 years experience in research and with 23 different analyses at their disposal, they'll help you select the one best steel for your operating conditions. And you're assured of uniform, high quality steel in every tube because of the Timken Company's rigid quality control from melt shop through final tube inspection.

Let our "RSQ"—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Div., Canton 6, O. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

STANDARD Gages

Widely Acclaimed

DuBo*

Plug Gage with High Visibility

COLOR FLASH Handles

Definite check, self-pilating, long wearing! As much as 70% to 80% lighter than cylindrical plug gages of equivalent size

*U.S. and Foreign Patents Granted

A few of many models to make your gaging job better . . . easier.

DIAL INDICATORS

Sizes and Models for all applications

Shockproof Mechanism standard on most models

DIAL BORE GAGES

Preferred when once used

7 sizes cover range ⅜" to 12⅛"

DIALIZERS

PATENTED

Quickly, easily, economically convert AGD Adjustable Limit Snap Gages to Dial Type

Write for Condensed Catalog B

Let us advise and help you on the fine points of gaging and inspection applied to your own work.

Adjustable Limit Snap Gages

Regular and Midget Models and the ultra-efficient SUPER SNAP GAGE with "spherical" pins

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

KEMPSMITH

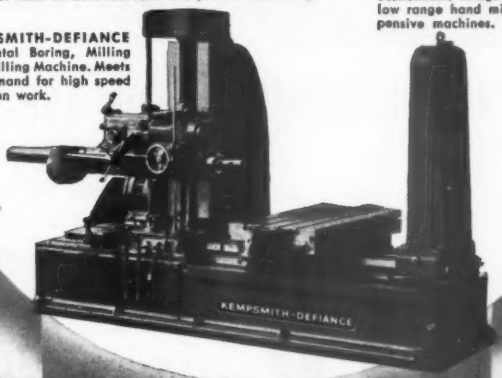
Ruggedness and Power Speed Up Machining Operations

The dependable Kempsmith line of machine tools includes the well-known Kempsmith Type G Milling Machines . . . the new, streamlined Type LH Miller and Kempsmith-Defiance Horizontal Boring, Milling and Drilling Machines. Also a complete line of Standard Attachments, Arbors and Accessories.

TYPE G MILLER — a precision-built all-geared milling machine. Ideal for both tool room and production milling.

TYPE LH MILLER — Modern, rugged, economical. Bridges the gap between low range hand millers and big, expensive machines.

KEMPSMITH-DEFIANCE Horizontal Boring, Milling and Drilling Machine. Meets the demand for high speed precision work.



Kempsmith machines and attachments are backed by more than 50 years' experience in the industry. Write for descriptive literature.

THE KEMPSMITH MACHINE CO., Milwaukee 14, Wis., U. S. A.

KEMPSMITH

• Precision Built Machine Tools Since 1888 •

A 6011-1PB-C

They're TUNGSTEN CARBIDE

They're PRECISION GROUND-FROM-THE-SOLID

Quality Engineered

BURS, REAMERS, END MILLS
BORING BITS & TOOLS
AND OTHERS BY ATRAX

THE
ATRAX
COMPANY

NEWINGTON IN CONNECTICUT

Write for our complete catalog *NOW!*

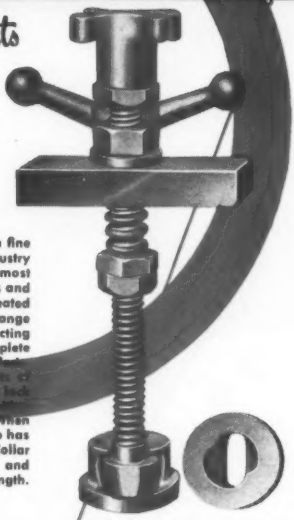
PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Morton

FIXTURE CLAMPS. . .

and Components

QUALITY and SERVICE . . .



with over 30 years experience in fine tool [illegible] recognized throughout the industry for the [illegible]ment and manufacture of the most economical and highest quality Fixture Clamps and Fixture D[illegible]. All precision made of heat treated selected ste[illegible] plated and in a wide range of sizes and [illegible] to fit the most rigid and exacting requirements. St[illegible] MORTON—Complete Clamp Assemblies [illegible]

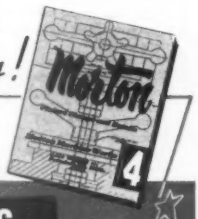
The Clamp Assem[illegible] shown here, consists of heat treated bottom insert, [illegible] tee bolt, three lock nuts, hand knob, spring, clamp [illegible] and either spherical collar nut or spherical ball handle. When ordering, specify which is required. Clamp strap has spherical seat which fits either of the nuts. Collar nuts, spherical ball handle, strap, tee bolt and bottom insert are treated for maximum strength. Finished in mid-nite black.

Removable Clamp Assembly

Clamping is done by the alloy tee bolt placed through the insert which is pressed into the bottom of the pilot plate. Hand Knob provides a convenient adjustable handle for removing clamp by twisting a quarter turn to the left. A spherical collar nut or spherical steel ball handle is used to tighten clamp strap. Adjustable nuts and spring prevents strap from dropping down during removal.

Any MORTON product can be adapted to whatever changes you might specify.

Write Today!



● LARGEST ASSORTMENT OF CLAMPS IN THE INDUSTRY...

MORTON MACHINE WORKS

[illegible] WOLCOTT STREET
DETROIT 26, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

New Flexible Sealing...
T-J AIR CYLINDER

Designed with revolutionary application of

Super-Cushion

It's *sealed with pressure*—a revolutionary T-J application of flexible sealing that insures positive cushion action combined with automatic valving action for fast return stroke... eliminates binding and sticking... operates with *low friction, minimum wear,* and *added power* due to higher efficiency.

More PLUS features! New type packing nut incorporates a piloted diameter, assuring perfect alignment. Improved rod packing increases sealing efficiency. Piston rod and internal cylinder tube surfaces are hard chrome plated—a standard practice with T-J for over 15 years.

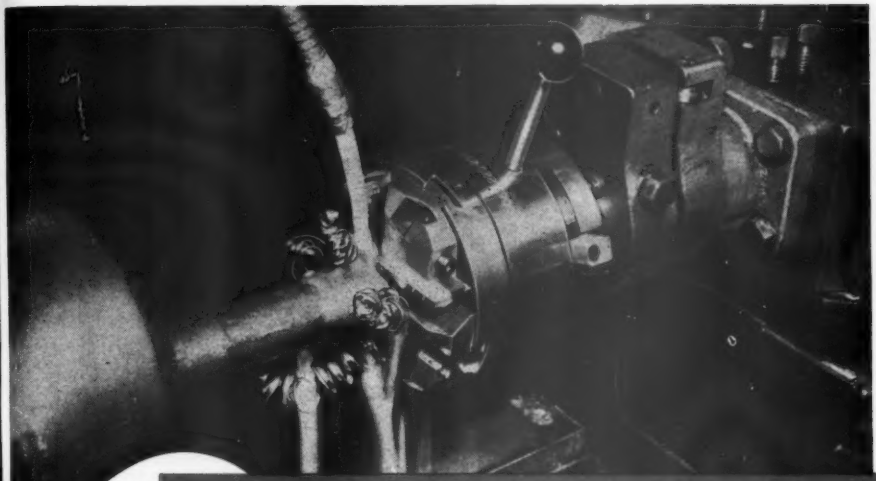
Write for bulletin 252... The Tomkins-Johnson Co., Jackson, Mich.

1. Metallic rod scraper to protect rod bearing and packing from dirt and grit.
2. Wrench flats.
3. Self-adjusting chevron type packing.
4. Permanent type adaptor ring.
5. Hi-tensile tie rods.
6. Heavy duty, hard chrome plated rod.
7. Generous fillet reduces stress concentration.
8. "O" ring static seal.
9. T-J new flexible cushion seal insures positive cushion with automatic valve action for fast return stroke. (Patent applied for)
10. Fine cushion adjustment.
11. Heavy wall precision honed hard chrome plate.
12. Controlled packing compression with metal to metal contact.

36 YEARS' EXPERIENCE T-J

TOMKINS-JOHNSON

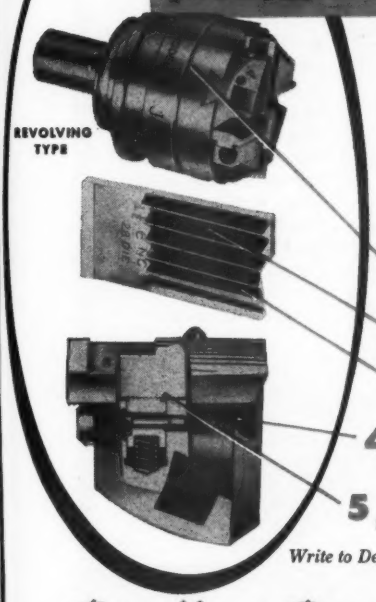
RIGHTORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS



JONES & LAMSON DIE HEADS

WITH GROUND THREAD TANGENT CHASERS

produce better threads at lower cost!



J&L Tangent Chaser Die Heads are rugged, dependable, time-tested tools. They are production engineered to produce better threads at speeds limited only by the material being threaded. Capacities are from #4 to 2".

There is a J&L Tangent Chaser Die Head engineered for your requirement. Stationary types are available for turret lathes or any machine where the tool does not turn. Revolving types are for automatic screw machines, drill presses, threading machines, or any machine where the tool is held in a live spindle.

Among the many features contributing to their ability to perform your threading job faster and better are these:

1. They are hardened and ground throughout. The chaser holding blocks are precision lapped for perfect fit into the dovetail slots in the body. Chaser cutting edges are held to a minimum distance from the die body.
2. Chasers are guaranteed to produce threads to Class #3 fit or better.
3. Exact helix angle is ground into the chasers after hardening. The result is a freer cutting tool—operating with a minimum of friction, heat and wear.
4. With a single set of chaser holders any standard thread within the rated capacity of the holders can be cut, regardless of helix angle. This eliminates the expense and trouble of constantly changing holders for different helix angles.
5. Chasers are changed and set quickly and easily, giving you more production hours each day.

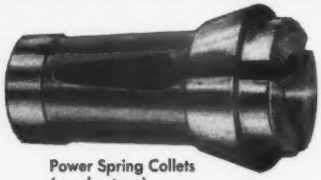
Write to Dept. 710 for catalog.

Die Head Division

JONES & LAMSON

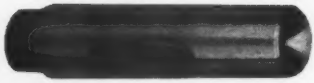
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835

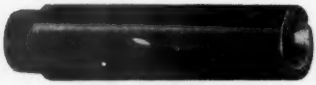


Power Spring Collets
(regular type)

Power Spring Collets
(taper nose type)



Feed Fingers (regular type)



Master Feed Fingers and Pads

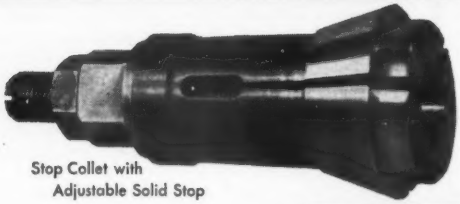
Master Feed Fingers
with Adjustable Tension

HARDINGE
ELMIRA, N.Y.

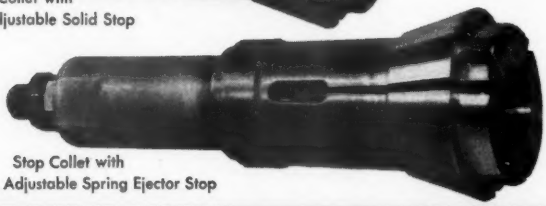
PRECISION PRODUCTS
for BROWN & SHARPE machines

For maximum production efficiency, specify Hardinge precision products for your Brown & Sharpe Automatics and Wire Feed Screw Machines. Reduce tooling costs and step up production with these and other Hardinge precision products engineered, customer-shop tested, and approved for Brown & Sharpe machines. Write for Catalog 36 — contains complete descriptions, specifications, and ordering information.

Deliveries from stock



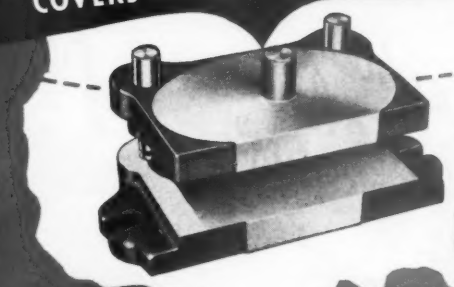
Stop Collet with
Adjustable Solid Stop



Stop Collet with
Adjustable Spring Ejector Stop

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

DETROIT DIE SET SERVICE COVERS INDUSTRIAL AMERICA



YOUR "DETROIT" DIE SET MAN CAN HELP YOU

Your "Detroit" Die Set man knows die sets. Call him in . . . talk over your die set problems with him. Get from him full facts about the accuracy of "Detroit" parallel surfaces, the trueness of pins, the fine finish, the thorough inspection at the factory. You'll see that "Detroit" leaves nothing undone to assure easier mounting and longer production runs. Call your "Detroit" man.

CALL "DETROIT"

DETROIT	TR 2-5150
BIRMINGHAM, ALA.	3-1341
BUFFALO	PA 9206
CHICAGO	PU 5-7694
DAYTON	HE 3042
INDIANAPOLIS	HU 5604
KANSAS CITY, MO.	VI 3558
LOS ANGELES	AD 7251
MILWAUKEE	GL 3-7170
MINNEAPOLIS	PR 1822
MONTREAL, CAN.	WI 1186
NASHVILLE	7-0437
NEWARK	MA 2-4318
PHILADELPHIA	VI 4-4084
PITTSBURGH	LO 1-4011
ROCK ISLAND, ILL.	R.I. 8-2814
ST. LOUIS	FR 6811
ST. PAUL	CE 1600
TOLEDO	MA 4510
TULSA	3-8193
WICHITA	5-8682
WINDSOR, CAN.	2-1575

DETROIT DIE SET CORPORATION
2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SET ★

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

They're calling him "Mr. Genius" now!

More production per grinding wheel dollar. That's why George is the boss's brainy boy. How did he get that way? Simply by changing over to a grinding wheel slightly different in grain and grade . . . a Simonds wheel, naturally. This could be a right, bright production boosting idea for you too. You'll find everything you need in our complete line . . . grinding wheels, mounted wheels and points, segments, abrasive grains. Let's send you our free Data Book and the name of your nearby Simonds Abrasive Company distributor.

SIMONDS ABRASIVE CO.
Grinding Wheels

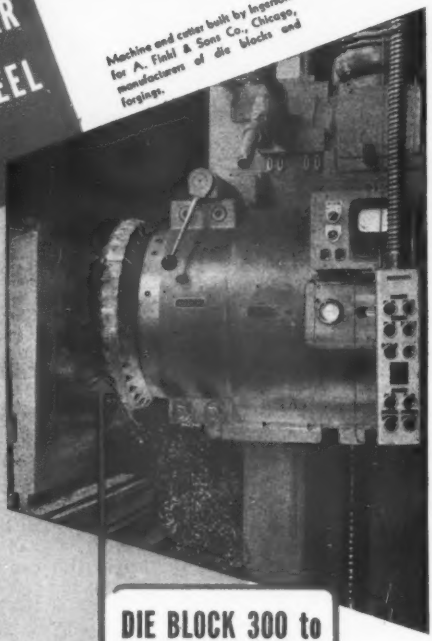
SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

INGERSOLL

SHEAR CLEAR CUTTER MILLS TOUGH STEEL with CARBIDE



Machine and cutter built by Ingersoll for A. Finkl & Sons Co., Chicago, manufacturers of die blocks and forgings.

● Die blocks now are being milled by this 24" Ingersoll Shear Clear face mill with carbide-tipped blades at a feed rate 10 times the feed rate attained with high speed steel cutters.

● High speed steel cutters machine 22,500 square inches of this hard, tough material in 150 hours, during which they have to be reground six times. With carbide, the same work is done in 15 hours without regrinding the cutters.

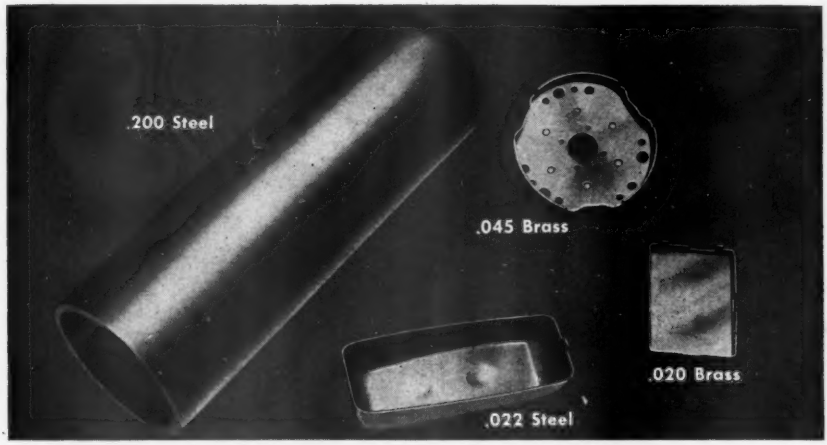
DIE BLOCK 300 to 375 BRINELL

● Many of our customers are using carbide-tipped Shear Clears to machine the hard steels encountered in manufacturing tanks and guns, turbines and diesel engine casings. In working with them on these difficult jobs we have gained valuable experience. We would appreciate an opportunity to put this experience to work for you.

THE INGERSOLL MILLING MACHINE CO. ROCKFORD, ILLINOIS

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

A BREHM DIE *NEVER BECOMES OBSOLETE!*



Reduces Original Cost . . . Cuts Operating Costs!

When model or part changes interrupt production, only the cutting adapters of a Brehm Die need to be replaced to continue full production. Don't overlook the fact that a single Brehm Die, using various cutting adapters, greatly reduces the original investment, to say nothing of reducing current operating costs.

The Brehm "Shimmy" Die has angular cams which cause the shearing edges to cut four ways in a single press stroke. Higher production and lower costs are possible because "pinch" and slow, costly "horn" trimming operations are eliminated. Materials, thicknesses, shapes and sizes can vary. Such as gold, silver, plastic, rubber, aluminum, copper, brass, zinc, stainless or mild steel. A refrigerator door, the case of a lady's watch, an artillery case, a business machine, aircraft or automotive part.

Perfect edges, clean, without burrs or distortion at the trimmed edge. Contours can be straight or curved, with single or multiple notches and projections.

For a free Brehm Die Catalog, write today. If you wish, and without obligation, send us your blueprint or the part for complete information or quotation.

Brehm TRIMMING DIES — THE "SHIMMY" REG. DIE ®

THE STEEL PRODUCTS ENGINEERING CO.

BREHM DIE DIV., DEPT. E, SPRINGFIELD, OHIO

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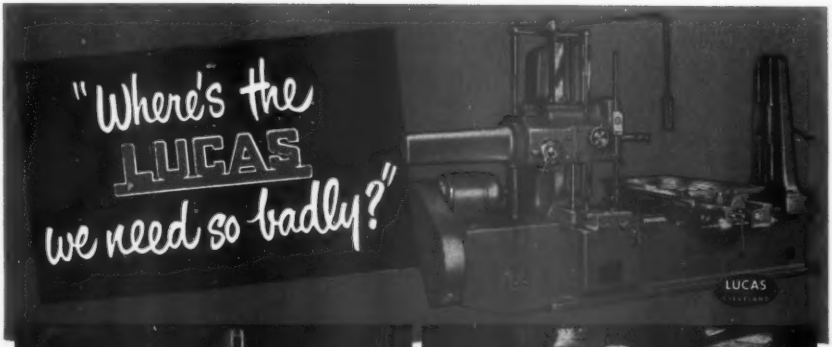
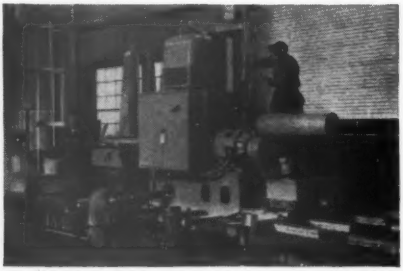


The ultra modern Lucas plant is being used to full capacity with work in process and rough castings waiting to be machined.

Lucas machines at work making components for more Lucas machines, in our plant and in the shops of many outside suppliers.

Still no sacrifice of Lucas standards. Ultra modern production methods, but still the skilled hand craftsmanship for which there's no satisfactory substitute.



More shipments than ever, but, of course, defense priorities dictate who gets what. Perhaps this is the machine we originally scheduled for you.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

FREE
TO PRODUCTION M
5 Helpful Bookle

TRU-THREAD
DIAMOND TOOLS
(FOR DRESSING THREAD GRINDING WHEELS)
Engineered
AND
MANUFACTURED
by
COMPANY

Diamonds AND
Diamond Tools
WHEEL TRUEING TOOL COMPANY
DETROIT 6, MICHIGAN

FORMING DIAMOND TOOLS
Engineered
MANUFACTURED BY
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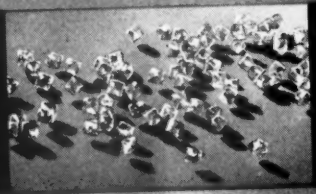
DIAMOND IMPREGNATED

TIPS
on Using
DIAMOND
TOOLS
for Best
Results

WHEEL TRUEING TOOL



TRU-LINE BLADE TYPE DIAMOND TOOLS (Pat'd)
RADIUS FORMING DIAMOND TOOLS
UNMOUNTED INDUSTRIAL DIAMONDS
STANDARD and SPECIAL DIAM
TOOLS OF ALL KINDS

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The booklets shown at the left are yours for the asking, with our compliments. Write for them on your letterhead telling us how many of each you require to supply your organization. Please address your inquiries to our nearest company office.

☐ DIAMONDS and DIAMOND TOOLS ☐ TIPS ON USING DIAMOND TOOLS
☐ RADIUS FORMING DIAMOND TOOLS ☐ TRU-THREAD DIAMOND TOOLS
☐ DIAMOND IMPREGNATED DRESSING TOOLS

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GIANT DIAMOND BIT for all well drilling

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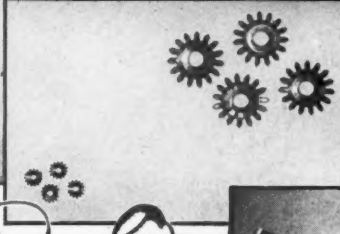
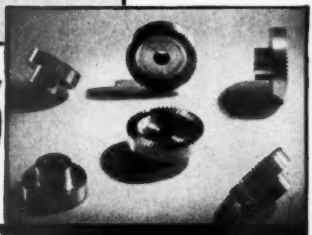


CROWN GEARS



Hamilton

NO. 1 PRECISION GEAR HOBBER

With built-in accuracy, and stamina beyond average requirements, the unique feature of independent selection of speed, feed, and indexing makes possible the delivery of a selected accuracy at higher speed, or a selected speed with greater accuracy than can be achieved by other machines. We are proving this daily. Complete information is offered in our free Bulletin No. H-491. Write for it now!

THE *Hamilton* TOOL COMPANY

832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

THE automobile industry created and grew with "planned production efficiency". From a large automobile manufacturer, a leader in production efficiency, comes the story showing the reason for an industry-wide switch to ERICKSON precision holding tools.

". . . Since installing ERICKSON collet chucks on all machines last year, we have reduced a breakage of 20 drills per day (as high as 40 when forgings were hard) to less than 3 or 4 broken drills a day. The full grip of ERICKSON collet chucks stops drill chatter and whip. Also, they permit the use of longer drills and drill stubbing giving greatly added drill life. The above figures are based on an average of 1200 crankshafts a day.

ONLY ERICKSON PRECISION CHUCKS...

1. Deliver guaranteed accuracy of .0005" T.I.R.
2. Grip along entire length of collet.
3. Replace 7 standard single-purpose collets.
4. Grip on drill flutes; permit stubbing and use of broken drills.
5. Permit use of greater feeds and speeds.
6. Prolong tool life.
7. Reduce set up time.

Write for Catalog "J" today

ERICKSON TOOLS
DIVISION OF THE ERICKSON STEEL COMPANY
2314-H HAMILTON AVE. • CLEVELAND 14, OHIO

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Nichols
TOOL ROOM MILLER

Accurate
Sensitive
Versatile

A compact, rugged miller that gives the tool room what it demands—extreme accuracy and utmost flexibility. The NICHOLS TOOL ROOM MILLER is arranged for sensitive hand screw feed. It has generous table surface of 8½" x 30", with 19" longitudinal travel. Precision feed screws are fitted with oversize, easy-reading micrometer dials. Large hand wheels provide the element of "feel" so important in precision milling. Rise-and-fall spindle enables easy handling of many difficult operations—increases usefulness—simplifies set-ups. Readily available are dividing head, vertical attachments, vises, and a full line of milling accessories. Priced surprisingly low. Literature on request.

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

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NICHOLS-MORRIS CORPORATION

76-X Mamaroneck Avenue, White Plains, New York

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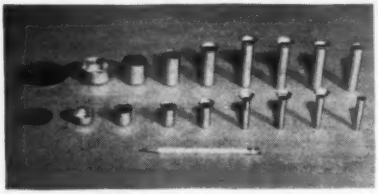
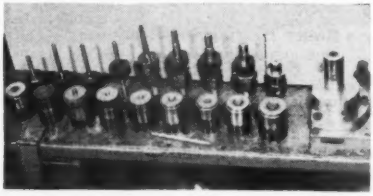
AT ADVANCE STAMPING COMPANY–

Output per press jumps 34½% with Carboloy dies

On typical drawing job, Carboloy dies average 100,000 pieces in 52 hours . . . other dies require 70 hours to do the work.



HERE ARE 2 typical 18% nickel silver stampings made at the Advance Stamping Company plant. The larger (top row), an electrical control part, is made from .025" strip. The smaller (bottom row) is drawn from .007" strip. On parts such as these, Carboloy dies may draw up to 500,000 parts without being repolished.



THIS IS a set of dies for deep drawing. Die set at the right is a blanking die; the others are draw dies and a pinch-trim die. Carboloy die nibs, purchased with ground O.D., are press-fitted into hardened tool steel for the dies. Except for boring tools, wheels and lapping compound, no special equipment is required to finish the inside diameters to size.

The practice at Advance Stamping Company is to specify Carboloy dies for all deep drawing jobs of 100,000 pieces or more. It really pays off!

On this specific drawing job, the extreme wear resistance of Carboloy Cemented Carbide dies saves 18 hours of maintenance time per 100,000 pieces. This, of course, has the effect of boosting output per press 34½ percent . . . greatly increasing *plant efficiency and capacity*.

Here are *plant-wide* results reported by Advance Stamping Company:

FEWER SHUTDOWNS: Carboloy dies give them a *minimum* of 5 to 6 times as many completed parts between resharpenings as tool steel dies will.

INCREASED EARNINGS: By standardizing on Carboloy dies they have been able to raise plant efficiency—and increase plant earnings.

DIE SAVINGS: Often the life of Carboloy dies is so long that dies are still in good condition after part becomes obsolete. (So they resize the dies and put them back to work on some other job.)

Other benefits reported by Advance Stamping include better product finishes and fewer rejects. Benefits that you, too, can get with very little effort.

Why not get the full story on long-wearing Carboloy dies? Call your local Carboloy representative, or write us direct for our free die engineering manual.

"Carboloy" is the trade-mark for the products of Carboloy Department of General Electric Co.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

CARBOLOY CEMENTED CARBIDE

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11111 E. 8 MILE STREET, DETROIT 32, MICHIGAN

Gentlemen:
Send me, free, your helpful Die Engineering Manual D-124. I want the full story on Carboloy carbide dies.

Name_____ **Position**_____

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NEW! PRESS-RITE NEW!

60-TON POWER PRESS..

featuring...

- Press-Rite Airflex Clutch and Brake System
- One-Piece Heavy Duty Frame With Built-In Tie Rods
- Triple Ramway Lubrication
- Non-Repeat Single Stroke Mechanism
- Roller Bearing Flywheel

NOW. . . . a 60-ton power press with all the famous Press-Rite features! Available in either flywheel or back-geared models, the Press-Rite No. 60 is designed with extra frame rigidity to eliminate deflection on heavy drawing and blanking operations. The large die space simplifies handling of bulky dies . . . cuts set-up time. The Press-Rite Airflex Clutch and Brake System delivers full stroke power through every operating cycle . . . provides positive, instantaneous braking action. High production . . . low maintenance . . . long dependable operation—these advantages make the Press-Rite No. 60 a profitable addition to your production line.

Write For Complete Information . . . TODAY!

Sales Service Machine Tool Co.

PRESS-RITE PRESSES · SHAPE-RITE SHAPERS · KELLER AUTOMATIC POWER HACK SAWS

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NEW! SUPERIOR "Removable Cap" GUIDE PINS

End Troublesome Binding In Die Set Assembly Work . . .

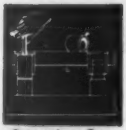
HEXAGON KEY REMOVES CAPS TO FREE PUNCH HOLDER . . . DIES PART QUICKLY and EASILY

It is no longer necessary to spend excessive time in assembling and disassembling large die sets! Superior's *NEW* Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind. Instead of needing 2 or 3 die makers to remove the punch holder from a set, one man can easily do this work alone in a few minutes. As a result overall die costs are substantially reduced. Complete information is available on request. Save by using these advance type guide pins in your die sets. Write, phone or wire your needs now!

Cut away view of NEW Superior Removable Guide Pin shows its practical construction.

THESE 9 FEATURES SAVE COSTLY MAN HOURS IN DIE MAKING

1. Removable caps prevent punch holder from locking.
2. Socket screws serve as jacks — caps detach quick and easy.
3. Self contained oil reservoir in each guide pin cap — oils bushings.
4. Designed for use on all die sets.
5. One man can remove large punch holder in approximately 3 minutes.
6. Punch holder assembled easier and more accurately.
7. Guide pins are precisioned machined and finished for long wear.
8. Taper seat for cap insures positive alignment.
9. Damage to costly dies in assembly and disassembly is eliminated.



Removing Cap

Parting Die Set

Replacing Die Set

FOR FAST LOCAL SERVICE CALL THESE SUPERIOR REPRESENTATIVES

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SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Hitch your product to the Star!

good judgment calls for
PARKER-KALON®
when good design calls for
SOCKET SCREWS

Your INDUSTRIAL SUPPLY DISTRIBUTOR—*your local source for P-K Socket Screws—works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

Put a P-K Ground Thread Socket Set Screw among any comparable set screws. See how its super-smooth, gleaming surface shines out like the brightest star against a midnight sky.

Used in your product, it's a *star* salesman. Any buyer associates topmost quality with Parker-Kalon ground threads.

It's a *star* in your production picture, too. Workers like its clean, burr-free contour, its sure, easy keying, its uniform, dependable Class 3 Tolerance.

Ask for samples. See why P-K Ground Thread Socket Set Screws will put your product out in front, assemblywise and sales-wise. Parker-Kalon Corporation, 200 Varick Street, New York 14.

SIZE-MARKED CAP SCREWS • GROUND THREAD SET SCREWS • FLAT HEAD CAP SCREWS • STRIPPER BOLTS • PIPE PLUGS • HEX KEYS

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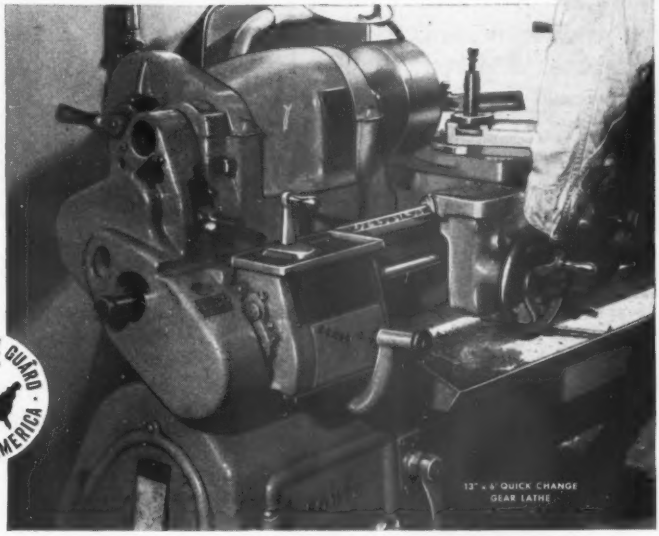
SOUTH BEND 13" LATHES

for Accurate, Low-Cost Machining

South Bend 13" Lathes are popular wherever there are a variety of precision parts to be machined. These quality-built lathes are fast and simple to operate. Set-ups and job change-overs are quickly and easily made. Maximum production at highest accuracy and lowest cost will reduce expenses in your shop. Write for complete information on South Bend Lathes and other machine tools.



AIR NATIONAL GUARD PROTECTS AMERICA

SWINGS: 13-1/8" over bed and saddle wings; 8-3/4" over saddle with chip guard removed.
BED LENGTHS . . . . . 4, 5, 6 and 7 feet
DISTANCE BETWEEN CENTERS . . . 16 to 52 in.
MAXIMUM COLLET CAPACITY . . . 1" (Collets interchangeable with South Bend 10" — 1" collet, 14-1/2", 16", and 16-24" South Bend Lathes.)
SPINDLE BORE . . . . . 1-3/8 inches
SPINDLE SPEEDS: Eight . . . . 40 to 940 r.p.m.
POWER LONGITUDINAL FEEDS: 48 R. H. or L. H., .0015" to .0841"
POWER CROSS FEEDS: 48 . . . . .0006 to .0312"
THREAD CUTTING: 48 R. H. or L. H. pitches . . . 4 to 224 per inch
CROSS SLIDE TRAVEL . . . . . 8-1/8 inches
TAIL STOCK SET OVER . . . 15/16"

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

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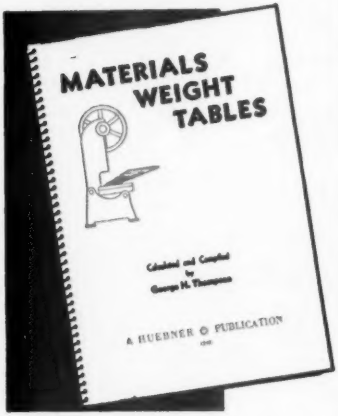
"KNOW-HOW" FOR SALE

COMPUTE stock weights QUICKLY

with Geo. H. Thompson's



Weights of sheet or bar stock or drill rod easily determined by one computation. "Faster Than a Slide Rule." $2.50 per copy.

PLASTICS MOLDS

by Gordon B. Thayer

Tells how to

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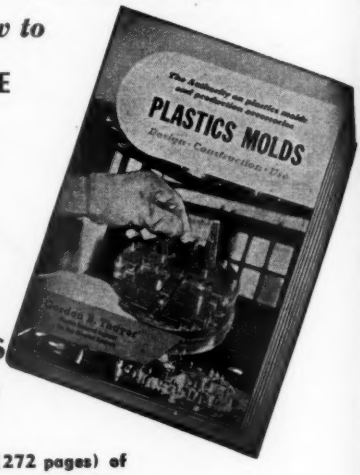
USE PLASTICS MOLDS



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BY E. WILLARD PENNINGTON

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BARREL FINISHING NEWS

TESTS PROVE "SUPER HONITE" GIVES TOP CUTTING SPEED

ST. PAUL, MINN.—Industrial research groups across the country recently completed a series of comparative tests on the cutting speeds and lasting qualities of all barrel finishing chips now on the market.

Results of these tests have just been announced by Minnesota Mining & Manufacturing Company—a leading abrasives manufacturer.

Punishing tests proved no other chip on the market cuts faster than "Super Honite."

This improved stone is formed by fusing grains of the world's toughest abrasive mineral—aluminum-oxide—with a ceramic, non-crystalline bonding agent that will not fracture or crumble.

LASTS TWICE AS LONG

The combination of a super-tough abrasive and a super-tough bonding agent gives "Super Honite" a 100% longer cutting life than other stones. In fact, *no other barrel finishing abrasive* lasts as long.

NEVER STOPS CUTTING

"Super Honite" never wears smooth. New cutting edges are constantly exposed as the surface area is slowly reduced.

Since the composition of each chip is the same throughout, used stones can be re-graded and used again on different operations, too.

See for yourself! Order a trial supply today. Write 3M, Dept. TP, St. Paul 6, Minn., for information and prices.

Barrel Finishing Experts offer you FREE services!

FREE BOOK

ST. PAUL, MINN. — Experienced 3M Engineers are now ready to work with you for increased barrel finishing efficiency, and a system that's tailored to your *particular* job.

Use the coupon below for immediate attention, and a copy of "3M Barrel Finishing." There's no charge or obligation.

Made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotch-lite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 270 Park Avenue, New York 17, N. Y. In Canada: London, Ont., Can.

Honite

Minnesota Mining & Mfg. Co.
Dept. TP, Saint Paul 6, Minnesota

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Address_____

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Better Cutting--
Greater Tool Life

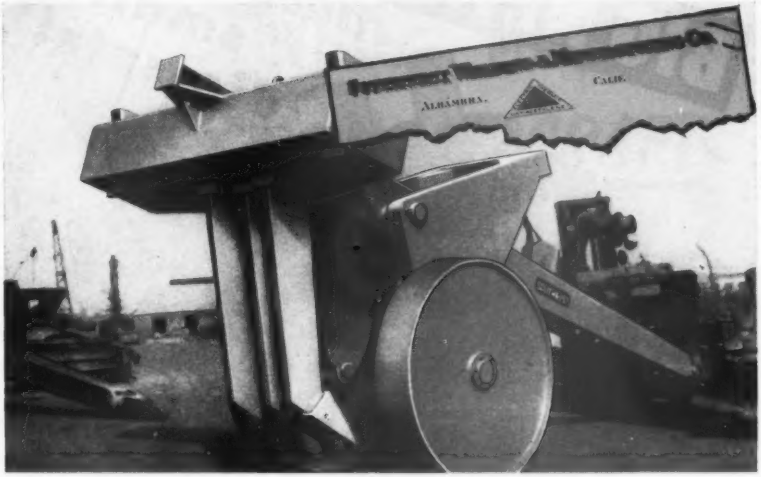
• Any good grinder hand can now produce this stronger, cleaner, faster cutting grind easy as regular relief. Let us send you our catalog that describes what D.S can do to cut your tool and machining costs. Illustrates the new motorized model.

D·S
Radial Relief
TOOL GRINDING
FIXTURE

Available with or without grinder and base.

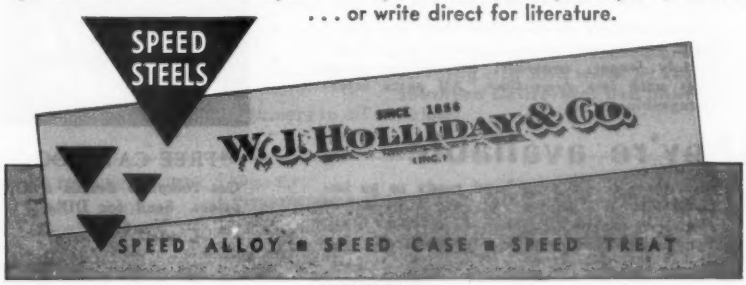
D - S GRINDER DIVISION
Royal Oak Tool & Machine Co.
621 E. Fourth St. • Royal Oak, Mich.

SPEED TREAT STEEL GIVES POWERFUL BRUTE A TREMENDOUS BITE



This Southwest Cable Ripper penetrates rock-hard surfaces to 60"—with shanks made of Speed Treat (X1545). These tougher biting, long wearing Speed Treat shanks have a 10-100,000 PSI tensile strength, Brinell of 156-196 plus a .45% carbon and 1.25% manganese content.

Thus, Speed Treat is amazingly versatile, too . . . used for countless applications where machinability, finish, tool life and hardenability are important including rubber molds, gears, sprockets, cams, cylinder bearers. Ask your Speed Steel distributor to explain how Speed Treat can improve your products . . . or write direct for literature.



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BIG NEWS about small die sets!*

They're new

Introducing: The result of 27 years of die set "know-how"! Incorporating the latest developments.

They're better

Special DIE-CO processes for finer, more uniform precision-finishing. Industry reports *definitely longer, smoother, trouble-free press runs with less down-time.* All parts interchangeable.

They're available

Big, complete stock on hand ready to go immediately. No delays. "Regular", "reverse" and "long-narrow" types in all standard sizes. Your order filled same day it is received.

DIE-CO Standard Die Sets

***FREE CATALOG**

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DIE-CO

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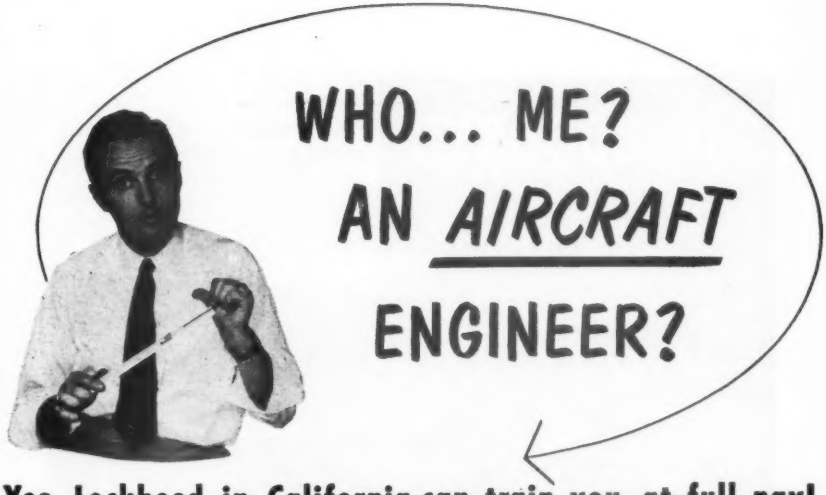

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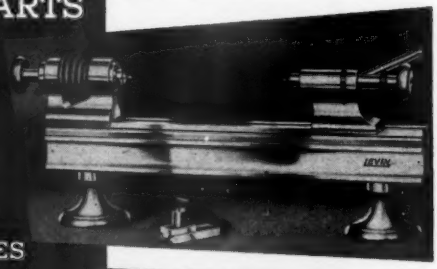

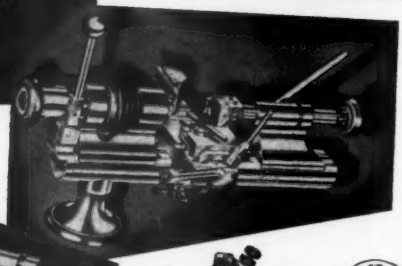

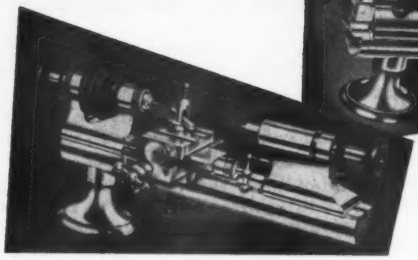

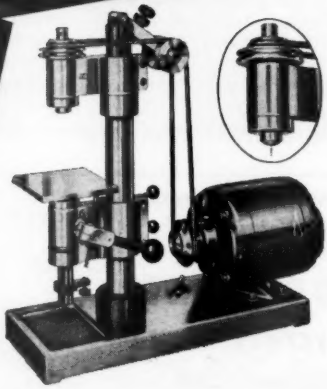

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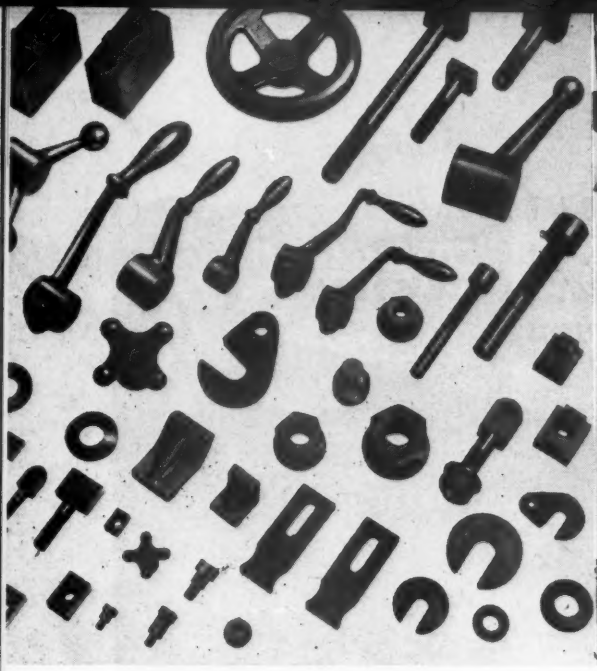

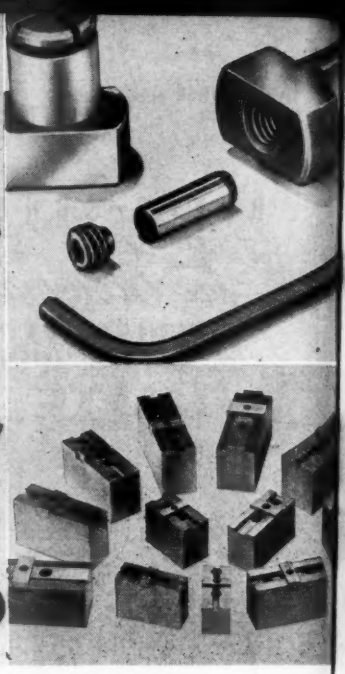

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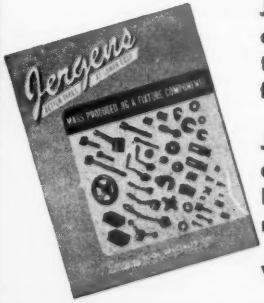

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tooling America's production lines

You may have noted, across the top of this month's front cover, the phrase: "Devoted to Tooling America's Production Lines."

Many of our readers of long standing may wonder at this reiteration of our well-known and well-established editorial activities. To those who have been reading TOOLING and PRODUCTION over the years it is far from news.

However, our circulation is growing and we must not let ourselves lose sight of the fact that each month TOOLING and PRODUCTION is mailed to some new readers for the first time.

To them we owe this statement of our editorial policy, this declaration of our purpose in publishing to them and for them.

First of all, we are very proud of our readers. By our own rigid standards of selection they are the "cream of the crop", the enterprise crop.

They are the men who, by virtue of their training, accomplishments and responsibilities, keep America's production lines producing. It is their job recognize the need for new tooling or retooling in order that their companies' end products may be made better, faster and more economically

Then, it is their job to "follow through", and to design and procure the tooling that will accomplish their objectives. Further, it is their job to put this tooling to work and to keep it working

To them, tooling is all-inclusive, and ranges from the humble twist drill to the fabulously intricate and expensive transfer machine. Tooling is their life, their bread and butter, the material embodiment of their incentive to create and to improve.

Knowing these men and their jobs as well as we do has enabled us to select those who receive TOOLING and PRODUCTION to extremely close tolerances.

By the same token, knowing these men and their jobs as well as we do is what determines our editorial responsibilities to them.

Each and every article, in order to contribute its share toward "Tooling America's Production Lines," must offer affirmative answers to such questions as: Is it authoritative? Is it based on proved and successful experiences? Is it stimulating in that it provides the reader with a logical line of pursuit toward the solution of tooling and production problems? Does it contain show-how as well as know-how? Is it concise (our readers are busy men) yet sufficiently comprehensive as to not generate unanswered questions?

These editorial specifications apply equally whether an article is "bird-dogged" by a member of our staff in visiting a plant, or results from our soliciting material from a recognized authority on a subject of widespread, as well as in those instances of articles contributed by those motivated by a desire to share their knowledge and experience. (And to these good people, our standing invitation to send us their accounts of methods, tool design and production shortcuts that are so helpful to others.)

Surely it can be said that TOOLING and PRODUCTION'S new readers will be keeping good company. As we have said, we are proud of our readers due to the high standards by which we choose them. May we be pardoned a bit of pride in the fact that the many who express their desire to receive TOOLING and PRODUCTION are, in effect, choosing us?

E. Willard Pennington

editor

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Each and every one of these new machines, tools and accessories is capable of saving money or increasing productivity.

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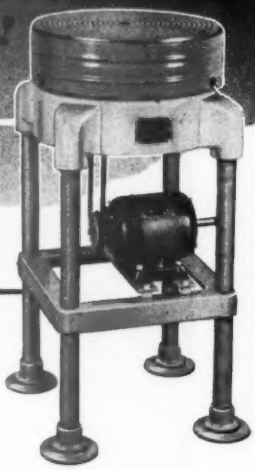

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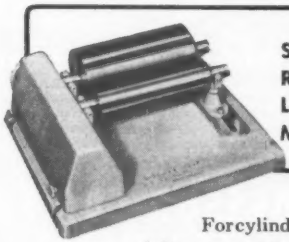

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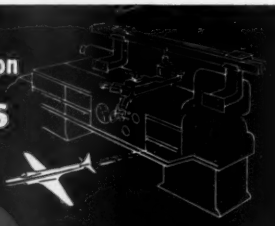

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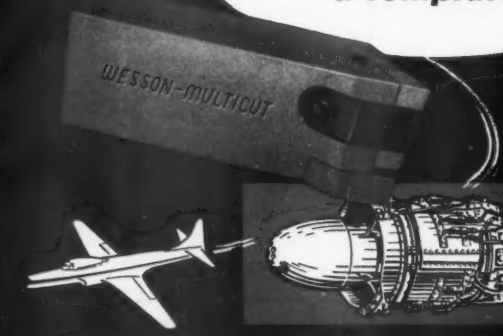

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Quality Control of Metal Stamping

Want to increase product quality level, decrease defective work cost and reduce total factory expense? The answer is a program of systematic inspection that fully utilizes the tools of statistical control. Such a system has been in effect at the Westinghouse metal stampings section for several years—has resulted in direct measurable benefits:

(1) Average outgoing quality level up 27 per cent

(2) Defective work cost within six years down 89 per cent

(3) Total factory expense down 1¼ per cent

In addition, these benefits have made possible better utilization of material, equipment and manpower. Not only has this meant a reduction in manufacturing costs, but it has also improved the ability to produce a greater volume of work for a given unit plant capacity.

Quality controlled workmanship is not an accidental or to-be-expected phenomenon —it must be developed! It involves finding the causes for defective work, correcting them and preventing their recurrence. In most instances, these causes revolve around material, machine and human elements — a big field, but one capable of further breakdown.

Process analysis is one of the many working tools available to the manufacturer. In appraising and controlling a process, whether it be metal stamping, plastic compounding, metal forging, electro-plating or any other mechanical operation, the manufactured product is the result of a series of operations and factors that combine to produce it. Therefore, each operation must be analyzed if the causes for defective work are to be found.

When a process is originally placed in operation, the quality control department must determine and establish the quality level. In this way, the ability to meet customers' tolerances and avoid customers' complaints at a later date is assured. The ideal goal is a system or process in which the tolerances of each phase of the manufacturing operation, as well as the final product, are normally distributed, and in which the variances do not exceed drawing specifications.

by **G. M. Bowen**
Staff Supervisor Quality Control
Feeder and Service Division
and
C. M. Smaltz
Manufacturing Engineer
Feeder and Service Division
WESTINGHOUSE ELECTRIC CORPORATION

Fig. 1. A special stacking fixture developed to align the slots of laminated punchings and to reduce damage to parts during the material handling phase of the manufacturing operations.

Raw Materials

A finished product is no better than the parts entering the final assembly area; likewise, quality punchings can be made only if the basic raw materials are of the highest quality. Since this must logically be the first stage of controlling quality, detailed specifications have been written by experienced material engineers. These specifications establish the standards by which raw materials received in the storerooms are controlled.

Of the more than 6,000,000 pounds-per-month of material entering the storerooms of the metal stamping section, 500 separate metal specifications may be handled. With this diversity, many suppliers are involved and, consequently, no one

system of inspection will guarantee the quality that is required.

Statistical data show that consistently good quality performance in the past justifies predicting good performance on future shipments. Based on this assumption, test results have been accumulated from each supplier over a period of years and the quality level on each specification has been determined. From these results, it is possible to select specifications that have been found erratic in each supplier's past history and to apply sequential lot sampling on those factors at the receiving inspection department.

To standardize the receiving inspection procedure, these data have been published in a "Blue Book of Inspection," a handbook used principally by the receiving inspectors. Not only does this book specify the required method of obtaining samples, sample size, physical and chemical test, but also the accept and reject limitations. Policies of returning marginally subquality material have likewise been standardized, and it is from these test results that material is rejected.

With increased quality control measures being adopted by industry today, it has become possible to accept materials endorsed by the suppliers' certified physical and chemical test reports. By this procedure, duplicate testing has been eliminated and it is possible to reduce many of the highly specialized chemical, physical and electrical tests. So dependable has this method become that over 1,500,000 pounds of metal per month entering the metal stamping area has been accepted under this plan.

To supplement these methods of inspection, a group of metallurgical engineers conduct periodic physical tests at the rolling mills prior to shipment. Statistically, these test results are plotted on probability paper, from which the average quality and degree of variability can be determined. If the three sigma limits, as calculated by this method, exceed the tolerances, the material is subject to rejection. Approximately 50 per cent of the material entering the receiving department has thereby been previously accepted on this basis, but inspection must be made to insure that there has been no damage in transit and that proper identifications have been maintained.

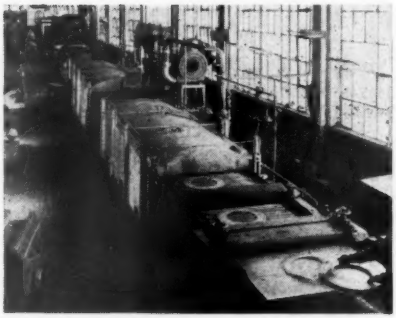


Fig. 2. Conveyorized roll-burr grinding operation to remove burrs from laminations, prior to silicate insulating and open-fired drying operation.

These various inspection methods have shown that products having a history of consistently good quality require less inspection. As a result, the amount of inspection in this department has been reduced, and yet a consistent and high quality level of raw material has been maintained.

Miscellaneous Punching Department

The small miscellaneous punching department does a wide variety of work ranging in weight from a fraction of an ounce to more than 15 pounds, and in order sizes of from one piece to one million (some requiring extremely close dimensional control, and some being only rough sheared). To control quality over such a variety of work requires a very flexible setup of inspection personnel. Because the inspectors in the metal stamping department have had wide experience, dependence is put on first piece and patrol inspection.

First piece inspection means the inspection of one or more pieces at the time of the setup or at the beginning of a shift to determine whether or not the machine has been properly set. It is the responsibility of the operator to have the first piece or pieces brought to the attention of the inspector.

When parts require more than one operation, each operation must be individually approved. The object is to determine if

(Continued on page 170)

Steam hammers do excellent work on many tractor parts including track rollers having undercut grooves, camshafts and track frame guides. Bending the track frame guides is started in a punch press and then is finish formed in a bulldozer.

Forging Die Design for Tractor Parts

Most forgings used in the tractors built by International Harvester Company at its Tractor Works, Chicago, are produced on steam hammers from billets heated in oil fired furnaces. Several upsetters also are employed and there is the usual variety of supplementary equipment in the forge shop. Practice compares favorably with that in most plants similarly equipped and includes certain jobs having noteworthy features of which a few are here described.

by **Charles G. Bezdal**
General Foreman
Forging Die Shop
Tractor Works
INTERNATIONAL HARVESTER COMPANY
Chicago, Illinois

Forging Track Rollers

Track rollers, in their completed form, are spool shaped parts but are made in different sizes and vary in the design of their flanges. Some flanges require a double lip and some have only a single lip. As the hub is hollow and end recesses are required in all cases, forging has to be done from the end, that is, with the roller axis at right angles to the die parting. This makes it necessary to produce the forgings in two parts, as the hub or barrel between the flanges is much smaller in diameter than the flange diameter.

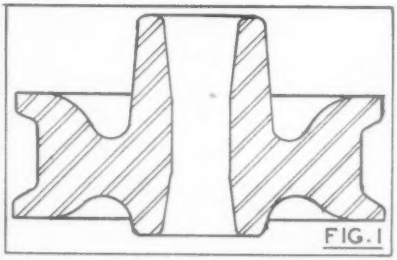


Fig. 1. Drawing of a forging for a half roller of the type that has two lips on the flange, the space between being an undercut formed by a split ring.

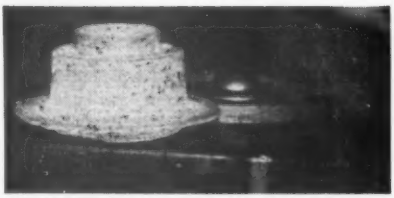


Fig. 2 Half forging for a track roller as it appears after the first forging operation in which one lip only is formed.

Consequently, the hub of each half is made long enough to permit joining the two halves by resistance butt welding after the forgings are completed, some of the hub ends being flashed off in the welding process. In Figure 1 is shown a forging of the type having a double-lip flange. It is one half of a track roller. As the space between the lips constitutes an undercut, it is necessary to use a split ring in conjunction with the die in order to make the undercut.

For the largest size of roller, billets 8-13/16" long are saw-cut from 6" x 6" round square stock, the steel being C-1049. Billets weigh 89 lbs. and are heated to 2280° F in an oil fired furnace of the automatically controlled pusher type. In the first operation of this tandem hammer setup, the billet is flattened between the flat faces of a die set in a hammer of the 8000-lb steam type. In the next operation the billet is brought to the shape shown in Figure 2. Figure 3-A indicates the cross-section shape taken by the part in the first forging operation and also shows the cross-section of the top and bottom dies. Most of the metal is forced upward

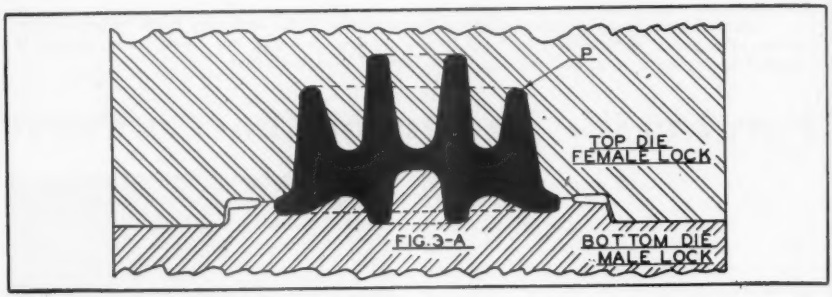
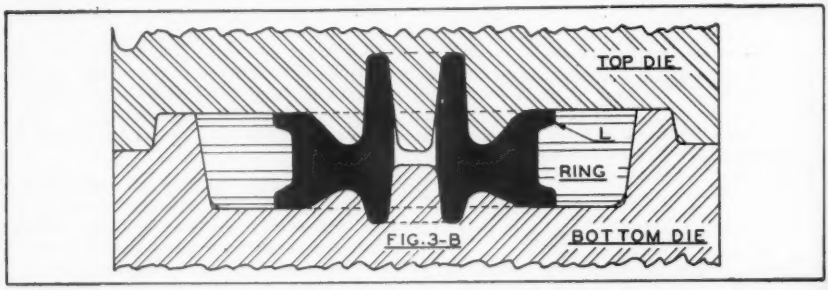


Fig. 3-A. Section through forging indicating the shape imparted to the part as the first forging operation is completed. Also shown are the sections through the top and bottom forging dies.

Fig. 3-B. Lip L is formed by bending projection P, Figure 3-A, down over the split ring. Sectional views of the top and bottom dies used to attain this shape are shown.



into the female die which is on the hammer side.

Flash occurs at the maximum flange diameter and is immediately trimmed off in a die as shown at E, Figure 4. To attain the lip pattern shown in Figure 1, the ring of projecting metal, P, Figure 3-A, is forced down to form the shape as shown at L, Figure 3-B. To accomplish this, the forging is transferred from the trimming press, without reheating, to the die shown in Figure 3-B which is set up in a 5000-lb steam hammer. After it is located in the die, the split ring shown in Figure 3-C is set down against the lip already formed. As the upper die descends, it strikes the workpiece and flattens the projection P, Figure 3-A, thereby forming the lip above the ring as shown at L, Figure 3-B. Then, both the ring and forging are lifted out of the die as in Figure 5. The ring is removed and its halves placed on the face of the die so that they are ready for use on the next cycle.

In this operation, flash is left at the top of the upper lip, as indicated at L, Figure 3-B, and is immediately sheared off in a trim die shown in Figure 6. The flash which is trimmed off the lip in this op-

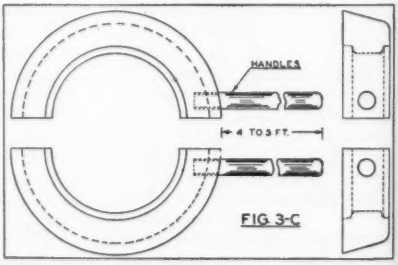


Fig. 3-C. Views of the split ring used with the forging die to form the lip L in Figure 3-B.

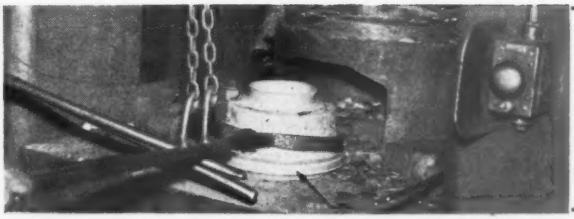


Fig. 4. Forging as it appears after being pushed through the trim die that shears flash from the first lip of the flange. E indicates the trimmed lip.

Fig. 5. In this second forging die, the split ring shown forms the groove between the two lips of which the second is produced by this die.

eration is shown at L, Figure 6, with the flash scrap piled up at T. This die is constructed so that it also pierces out the slug in the central hole. This completes this half of the forging and it then goes onto the cooling conveyor, Figure 7, after which it is ready for transfer to another department where the welding is done. Production in the above tandem hammer setup averages 31.25 forgings an hour and they weigh 83.5 lbs each. Heat-treating follows the butt welding of two identical forgings.

Forging Camshafts

Camshafts such as are shown in Figure 8 are produced from C-1045 killed induction hardening steel, the stock being ⅛" round corner square billets 38" long that weigh 48¼ lbs each. Forging is done in a 12,000-lb. steam hammer, the die having the fuller, roller and final impressions. Heating to 2220° F is done in a pusher type oil fired furnace. The fuller lengthens the billet and effects a rough distribution of the metal by drawing the stock at points where least metal is needed. More precise distribution and "ironing" to generally cylindrical sections are effected in the roller impression, and the final forging to shape is done in the remaining impression.

(Continued on page 100)

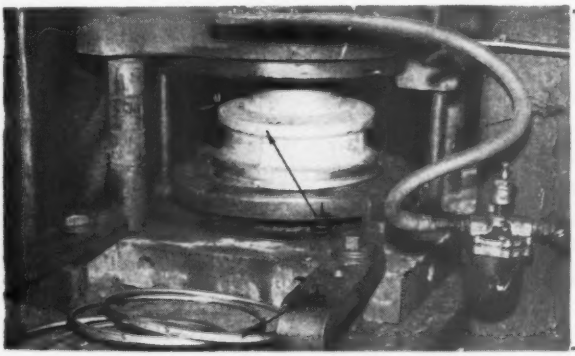


Fig. 6. Flash is sheared from the second lip of the half roller forging in this die which also pierces a slug from the central hole. L indicates the flash and T the trimmed scrap.

Versatile Drill Units Simplify Setups for Production Drilling

The portable automatic drill head having built-in controls, self-contained air and motor power is probably one of the most versatile, adaptable, and highly productive light drilling units available today. It easily fits into an extreme variety of setups and is used in so many unconventional ways that it has become a dependable, low-cost answer to many production small hole drilling problems.

by **George J. Zavis**
THE DUMORE COMPANY
Racine, Wisconsin

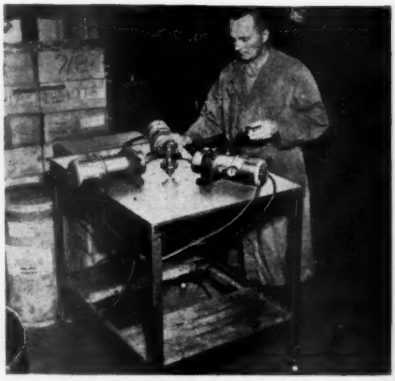
Operating from any electrical outlet and in any position, the automatic drill head requires no air connections. However, an external air source is often used to clamp the workpiece in a fixture to speed up loading and unloading, for the indexing of work, or to serve other auxiliary functions related to work handling. A built-in universal electric motor furnishes drilling power, while a rotary vane compressor mounted on the upper end of the armature shaft develops the air pressure that advances drill through the workpiece.

Few drill press operators have the sensitive touch to drill very small holes without excessive drill breakage. Soft and hard spots, varying degrees of hardness in the same piece of material, often present a difficult problem to the hand operator. Too much leverage instantly breaks a drill. Slow deliberate feed consumes time, cuts production.

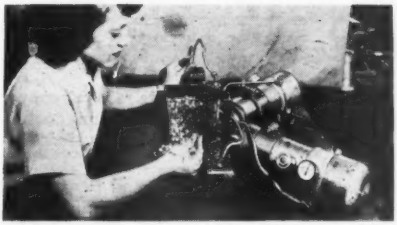
The Dumore automatic drill head operates on a new, unique "resistance" drilling technique whereby material hardness determines feed and speed of drill. Once the "normal" air pressure has been established, the proper setting is quickly made; thereafter, the unit is entirely self-compensating in terms of feed and speed, according to the pressure exerted on the drill point by resistance of material being drilled. High production and big reductions in drill breakage and scrap losses are natural results, as the drill always operates at maximum efficiency.

The drill heads are mounted singly or in batteries on standard or special bases,

Mounted on standard drill press column, Dumore automatic drill head drills two #54 tie-wire holes in stainless airplane nut. Production is increased 300%.



Three Dumores mounted radially on table equipped with casters drill 1/16" oil retainer holes in diesel timing gears. Unit is completely mobile for use in any department. Production upped from 50 to 150 pcs/hr.

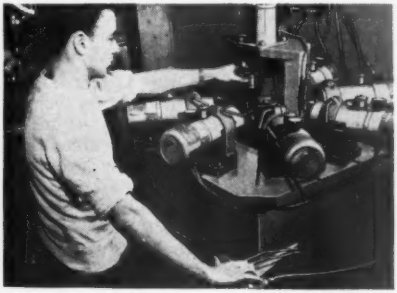


Two units mounted horizontally on different planes drill two holes 1/8" and #50 in brass shutter sleeve for hot water heater manufacturer. Production is 8000 pcs/day compared to 3600 with two operators.

drill press column, horizontally, vertically, in any manner or position required to do the job. Whether single or multiple set ups are used, these automatic drill heads are establishing high production records at low cost in equipment, fixtures, drills, and scrap.

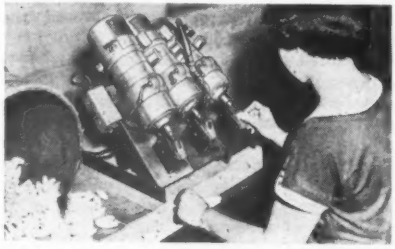
Users particularly like the adaptability and portability features of these units. They can be moved from their mounting after a production run is completed and immediately set-up in other departments for unrelated drilling operations. Some users have mounted the units, along with universal fixtures, on tables equipped with casters to be moved as the work demands. Very seldom does equipment of this type stand idle for lack of work.

The accompanying photographs of typical applications clearly illustrate the drill head's adaptability and versatility on a wide range of production small hole drilling operations.

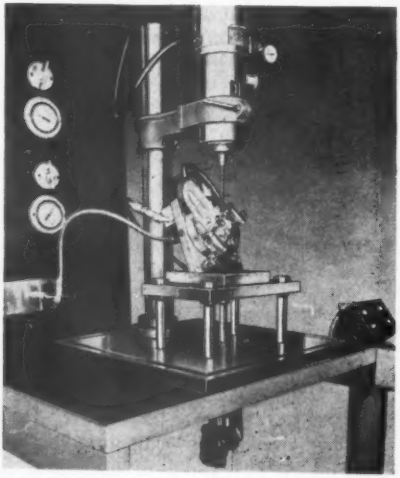


Eight drill heads mounted radially on horizontal plane drill eight oil retainer holes in pistons. Increased production from 80 to 350 pcs/hr. The same base is used in mounting 12 drill heads to drill 12 holes in larger size piston.

Three drill heads muunted on bench stands drill #56 tie-wire holes in hex head screws. Production is upped 2½ times.



Three drill heads mounted at varying degrees from vertical perform three drilling operations in plastic fish lures. Production upped 150%.



One Dumore converted into a completely automatic recycling drill press with push button control for actuating the unit, raising and lowering fixture, indexing, and clamping. Drills two #54 angular holes in aluminum die cast parts. Production upped from 315 pcs/day to 1197. Drill breakage cut from 21 to one per 1000 pcs.

To insure successful blanking, forming and drawing operations, consideration must be given to the

Annealing and Heat Treatment of the Copper Base Alloys

Annealing

In an operational procedure such as press drawing, spinning, cold heading, etc., or in such mill working as rolling of sheet or the reduction of wire diameters, the cold working of a specific alloy will involve stress concentrations in the area of cold deformation. The physical manifestation of this stress would be indicated by an increase in both the hardness and the tensional properties of the alloy accompanied by an increase in its ductility.

As with other types of materials that can be worked in a similar manner, the copper base alloys have a limit of workability beyond which further deformation may result in damaging of the part. This limit of workability is usually determined on the basis of previous experiences, or on the basis of trial and error.

In order to permit additional cold working to be performed, it is necessary to perform a heat treatment operation known as annealing which restores, to a large extent, the original ductility of the metal; this operation being a function of both time and temperature, each pre-determined for the specific alloy.

Table I gives the annealing temperature range for a variety of alloys.

The requirements for annealing will vary in accordance to such factors as (a) the alloy composition; (b) the extent of previous cold working that has been done; (c) the amount of additional cold working yet to be done; (d) the proximity of the anneal to the final operations; (e) the thickness of the metal; and, (f) the final specifications of the article.

by **Lester F. Spencer**
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

As mentioned previously, annealing is primarily a function of both time and temperature; the operation ordinarily consisting of heating the alloy to the recrystallization temperature and, if permissible, somewhat beyond that so as to cause grain growth. If the annealing involves the single phase or 'alpha' copper alloys, the rates of heating and cooling are relatively unimportant provided uniformity is maintained.

Thus, where the design will permit and distortion is not of prime importance, spray quenching is often practiced. However, factors such as source and application of heat, furnace design, atmosphere control, etc. are of importance since they affect both the uniformity, finish and cost of operation.

In some instances, the subject of the 'as annealed' grain size may be of considerable importance especially where the completed article is to receive a high finishing operation such as buffing or plating. Where either the temperature or the time factor is above the value necessary to produce this fine grain size (the temperature factor having a greater influence or grain size) an orange peel effect will result; this phenomenon visually manifesting itself in subsequent forming operations resulting in that considerable expense may be necessary to obviate this undesirable effect.

Grain size can also control the extent of fabrication that may be realized after an anneal since a too small or an excessively large grain size may cause breakage; the optimum being dependent mostly on past experience in the manufacturing of the specific part. Also, where minimum values for either hardness or tensile strength are specified, grain size values cannot be allowed to become too large.

Unfortunately, due to those factors previously mentioned, there is no definite pattern that can be followed in regard to time and temperature of annealing that will result in a specific grain size in a completely recrystallized metal. Usually, it is recommended to anneal at the lowest temperature possible since the work can always be returned to the furnace for further annealing, whereas damaged parts due to a high annealing temperature cannot be corrected. The influence of those factors mentioned can be briefly summarized, thus:

Table I. Range of Annealing Temperatures for Fabricated Articles*

Material	Chemical Composition, Percent			Anneal for Additional Cold Work deg. Fahr.	Fine Grain Anneal for Finishing deg. Fahr.
	Copper	Zinc	Others		
Copper				750 to 950	650 to 800
Red Brass	85.00	15.00		900 to 1150	750 to 900
Cartridge Brass	70.00	30.00		850 to 1100	700 to 850
High Brass	66.00	34.00		850 to 1100	700 to 850
Commercial Bronze	90.00	10.00		925 to 1175	775 to 975
Silicon Bronze, 3%	97.00		Silicon—3.0	1000 to 1200	925 to 1000
Silicon Bronze, 2%	98.00		Silicon—2.0	1100 to 1200	925 to 1000
Phosphor Bronze, Grade A	94.35		Phosphorous—0.15 Tin—5.5	1080 to1200	900 to 1050
Nickel Silver, 18%	65.00	17.00	Nickel—18.0	1100 to 1300	1050 to 1150

*It is suggested that temperatures be kept on the low side unless experience indicates that an increase is necessary.

Courtesy - Bridgeport Brass Co., Bridgeport, Conn.

(1) For a fixed time and metal temperature and for the same previous cold working in a copper-zinc alloy, an increase in the copper content above 65 percent results in a decrease in the grain size is a change in the mechanical annealing of the nickel-silvers, an increase in grain size is realized as the zinc content within the alloy increases. Thus, it is often recommended, where inter-stage annealing is required to complete fabrication of a given part, that the high zinc nickel-silver composition be avoided.

(2) After recrystallization of a brass composition, any increase in the temperature of the metal will result in an increase of the grain size; this grain growth is not in proportion to the increase in the temperature of annealing, but rather accelerates with such an increase. Accompanying the increase in grain size is a change in the mechanical properties of the alloy; the decreases in tensile strength, yield strength and hardness being accompanied by an increase in both the elongation and reduction in area as manifest by the testing of a standard tensile test bar.

(3) With any fixed temperature chosen for annealing, an increase in time at that temperature will promote grain growth, however its effect is not as pronounced as that when the temperature of annealing is increased.

(4) As prior cold working increases in severity, the lower is the softening or recrystallization temperature of brass. The speed of grain growth and recrystallization also tends to decrease.

(5) For given values of annealing time and temperature of the alloy, the larger the original grain size before working the larger is the grain size after recrystallization.

(6) With a given amount of cold work, grain size after annealing will vary in accordance with the type of furnace equipment employed. Every furnace should be calibrated especially as to source of heat, "temperature head", cross-section of parts, weight of charge, time, and grain size tolerances.

Due to the uniformity of metal temperatures that are realized, the convection types of annealing furnaces are widely used for temperatures from 1200 deg. Fahr. and lower. The thermocouple is usually placed in the hottest zone of the incoming gases, since controlling from this point will assure that the alloy will not be overheated. On the other hand, direct fired furnaces are usually operated with a "thermal head" and can cause an uneven heating of the load, especially where there are differences in the cross-sectional areas within the parts being annealed.

The practice of speeding the annealing operation by raising the furnace temperature considerably above the desired annealing temperature and subsequently lowering this temperature is not recommended due to the overheating that is experienced on the top or edges of the load while the rest of the load is coming up to the desired annealing temperature. It is

(Continued on page 108)

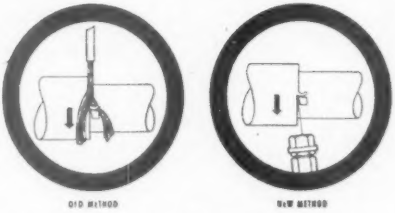
"Hi-Jet" System Increases Cutting Tool Life

A new, twin development, Hi-Jet and Gulf Hi-Jet Oil, has demonstrated the capability of increasing cutting tool life from 300 to 1200%. Both are products of the research laboratories of the Gulf Research & Development Company, a subsidiary of Gulf Oil Corporation.

Conventional cutting oils on single-point tool machining operations have acted more as coolants than as lubricants, when applied by conventional methods. And even as coolants they cannot perform efficiently for the same reason that they cannot lubricate satisfactorily: they seldom reach, in sufficient volume, the area where the heat and friction are generated. Thus, their main function has been to remove heat conducted through the chip, the work, or the exposed shank of the tool.

Examination of the machined surface as it leaves the cutting edge (viewed from the rear of the lathe) finds it bright and perfectly dry, indicating that little or no cutting oil has reached the cutting edge in spite of the flood of oil over work and tool. This is understandable with cutting pressures reaching 50,000 lb. per sq. in. and higher. Other evidence: built-up edge on the tool and the fact that failure usually occurs at or near the nose, the most inaccessible part of the tool for the coolant.

Hi-Jet represents a radical departure from the conventional method of lubrication, and its operation is surprisingly ingenious. Small high-speed jets of oil are directed, not from above, but from below the tool. The streams of oil pass through the space between the work and the side relief face of the tool and are aimed at the line of contact between the work and the cutting edge. Part of the oil is forced past the cutting edge and is caught between the chip and the tool. Now, for the first time, the tool is being efficiently lubricated, and heat transfer away from the cutting edge is greatly improved.

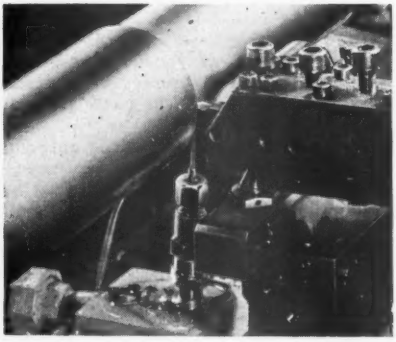


Diagrammatic drawing (left) shows the old overhead flood method. Note that chip completely obscures the cutting edge of the tool. The Hi-Jet method (right) shows how Gulf Hi-Jet Oil is forced past the cutting edge under high pressure.

How is this known? Because the chips as they leave the contact area are coated with oil; tool build-up is eliminated; nose wear is reduced; and chip crater is more uniform.

How does the oil get past the cutting edge of the tool? A pressure of a few hundred lbs. per sq. in. is not sufficient to push liquid oil past the edge where a pressure of 50,000 lb. per sq. in. or higher is encountered, or at least past those points where the tool and work are in intimate contact.

But since there are slight irregularities in both the cutting edge and the work surface, tiny passages are formed. Possibly machine vibrations assist in enlarging these openings. It is doubtful, however, if the jet pressure is sufficient to force



A small high-speed jet of Gulf Hi-Jet oil directed from below the tool passes through the space between the work and the side relief face of the tool. Tests and demonstrations made under conditions of close and accurate control show that for the first time in actual cutting history the tool is being efficiently lubricated and heat efficiently transferred away from the cutting edge.

the liquid oil through these tiny spaces because of excessive fluid friction.

However, since the edge temperature is well above the boiling point of the oil, the liquid is vaporized and, as a vapor, can be forced through these openings. In the process of vaporizing, the oil picks up considerable heat from the most critical area, the cutting edge.

After passing the cutting edge, the hot oil vapor condenses on the cooler chip and the tool shank, and gives off the heat picked up at the cutting edge. This action partially accounts for the improved cooling action provided by Hi-Jet and Gulf Hi-Jet Oil. The excess flow of liquid oil outward along the underside of the cutting edge also removes heat.

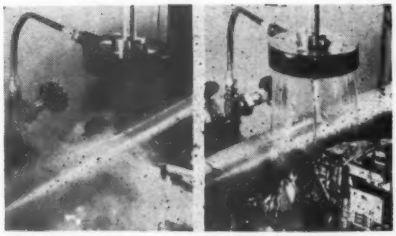
The condensed liquid oil is trapped between the tool and the chip, just exactly where it is needed to reduce frictional resistance to chip motion.

During the course of the experimental work on Hi-Jet, it soon became evident that the nature of the oil has a tremendous bearing on the effectiveness of the system. With some oils the results are only slightly better than with the overhead flood method, yet with others results are outstanding.

An intensive development program was launched to determine what oil properties affect the efficiency of the Hi-Jet and to incorporate all of these properties into a single oil that produces the best possible results. More than 50 different oils and additives were investigated and one by one the less desirable were discarded.

Gulf technologists collected a wealth of information on the new system and its performance characteristics and, as a result of this extensive research program, they developed an oil that has proved to be superior. This new oil, after further refinement, was named Gulf Hi-Jet Oil. It combines all the properties necessary to produce the best results in the Hi-Jet System and is recommended for all Hi-Jet applications.

In the test work at Gulf Research Laboratories every effort has been made to reduce all variables to a minimum. All tests were made on a standard turret lathe. The test specimens of each type of steel were all taken from a single heat and carefully heat-treated to maintain the higest possible degree of uniformity in machinability.

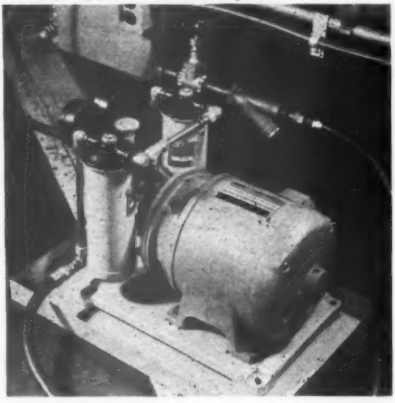


Evidence that the oil is actually reaching the cutting edge of the tool is shown in the photo at the left by the great amount of smoke generated at this point as a result of the high temperature involved. To control this smoke an additional attachment has been developed which serves as a smoke quencher. Photo at the right shows that a curtain of oil from this unit, which consists of shower heads above and beneath the Hi-Jet, almost completely eliminates the smoke.

The tools were very carefully ground to a standard finish in jigs. No hand stoning was permitted because of the difficulty in controlling this operation. The tool dimensions in all cases were those recommended by the ASTE Handbook for the type of steel tested. Tool life was the

(Continued on page 120)

Hi-Jet has only a few parts, consisting of a motor-driven pump, filter, pressure-regulating valve, jet nozzle, nozzle holder, and special low-pressure coolant spray. The suction side of the system is connected to the existing coolant system and the discharge and is connected by flexible hose to the jet nozzle. This is a rear view of the motor, pump, and associated parts.



Die and Mold Duplication (Continued)

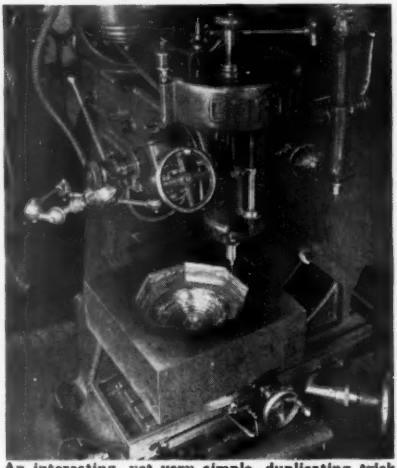
Milling Chief Means of Duplication

In the nature of the case, milling is the type of operation most employed in die duplication work. Some duplicating machines, as they are referred to, are essentially vertical milling machines, and can often be used either for regular vertical milling operations or for duplicating, whichever may be desired. However, some of these machines have been rather exclusively designed for tool and die milling and incorporate a hydraulic-tracer mechanism which provides for accurate duplication of different complex shapes.

No particular skill on the part of the operator is required. The hydraulic mechanism is a completely automatic tracer, which synchronizes the vertical movements of the machine spindle with the table or saddle movements. This simplifies production of dies and other complex shapes.

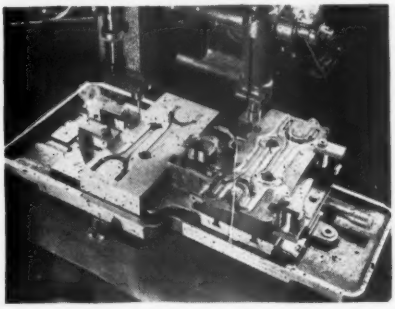
by John E. Hyler

One very fine machine of this type can be provided with a duplex rotary-table attachment when desired, which allows completely automatic duplication on many types of mold and die work. It really converts the machine into an automatic die sinker, capable of accurate duplication of complex shapes and intricate detail. Only casual attention from an operator is required.



An interesting, yet very simple, duplicating trick is shown here. A repetitive and decorative design was cut into the side walls of this octagonal mold by indexing the mold to eight different positions while the table of the Gorton machine was locked against longitudinal movement. A simple sheet-metal template, at the right, was mounted as shown. The follower stylus was traversed over this template each time, the design being cut by using the cross feed table screw.

Close-up of a Gorton vertical milling machine, designed to receive a duplicator tracer arm and spindle at the right. The job in process is an exact duplication of a double-cavity replacement dies for connecting rods. Shifting the entire duplicator table by means of a machine table screws allows both cavities to be cut without resetting. Over-all production time on this job is approximately 6½ hours per cavity, which is about half that for die sinking by usual methods. Greater accuracy in tolerances is obtained by this means, as well.



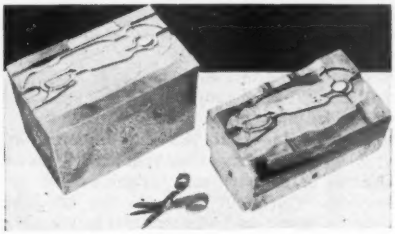
This attachment incorporates a pair of circular tables, which are rotated in perfect synchronization from an individually-powered driving mechanism. A chain drive from the power unit to the saddle cross-feed screw provides a continuous though very slow cross-feed movement to the rotating tables. This cross-feed movement, in turn, provides a continuous pick-feed increment for each revolution of the tables. Therefore, the cutter and the tracer are automatically traversed across the work and the master as they rotate, until a complete job is finished. The result is evenly-

spaced feed lines, which greatly simplify and shorten final finishing operations.

Reverse Image Attachment

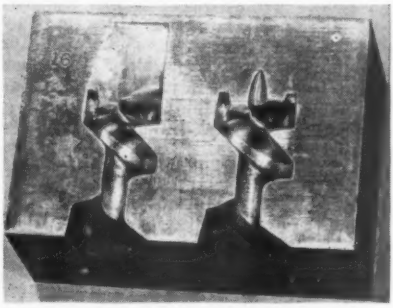
A highly interesting aspect of this particular machine is the fact that a reverse attachment is available, which will allow making left-hand reproductions from right-hand masters, or vice versa. Therefore, using a single master, one can make either an exact duplicate of that master, or a reversed reproduction, or both, as desired.

The attachment consists of an auxiliary table which can be mounted on the right-hand side of the machine table. This auxiliary table is under control of a gear and double-rack arrangement. As a result, it moves in the opposite direction from movements of the machine table proper. The size of impression which can be duplicated with this attachment, however, is limited to about eight inches in length because the work and the master are moving in opposite directions.



Above: This shear die set was made (or duplicated) from tempered steel. The forging-die blocks were already hardened to the limit of machinability. They were duplicated in a short time, considering the working characteristics of the material. The machine used was a Gorton duplicator of the vertical milling machine type.

Below: An auger-bit forging die. It was duplicated on a Gorton vertical mill type of machine complete in two and one-half hours, with accuracy limits of .002", except in the corners, which were left with 1/32" radius, and quickly removed when hand polishing. Duplication was made in free-cutting annealed tool steel from an original die.



A Gorton manually-controlled duplicator of vertical milling machine type is here seen in process of duplicating a die for die casting coin chutes for telephone pay stations. This die, when formerly laid out by hand and cut to line, required over 100 hours to produce, but was completed on the duplicator in 36½ hours, including the ejector-pin holes.

Some automatic duplicating or die-sinking machines, which are very well known and extensively used, are actually powerful horizontal milling machines. On these machines, all movements of the cutting tool, in whatsoever direction, are operated by electrically-controlled power feeds. The feed controls allow the machine to duplicate the shape of the master automatically. A machine of this kind is sometimes used to profile in two dimensions or directions only, though it is also employed for reproducing reliefs in three dimensions as desired.

Whatever the type of die or mold being duplicated, a tracer passes over the model, and the cutter faithfully follows a path identical with that of the tracer. Electrical contacts are provided in the tracer, and the amount of pressure exerted on the

(Continued on page 172)

The job of "Tooling America's Production Line" involves more than milling cutters and drill bushings. When we consider that today's tooling objective is to produce more, better, and at lower cost, we must recognize that Quality Control is just as truly a tool as is a transfer machine.

International Harvester Demonstrates a $10,000,000 Quality Control Program

A quality control system now in operation at twenty-one of the International Harvester Company plants has improved product quality, cut basic material requirements and eliminated $10,000,000 worth of labor and material losses over a four year period. Typical applications of quality control were revealed in an exhibit at the ASTE Industrial Exposition last month.

The International Harvester Exhibit was a main feature in the Exposition's Precision Control Hall where equipment and devices that assure production of accurate parts and reduce scrap were on display. While International Harvester is not a supplier of precision control equipment, it took the space as a service to industry to show what can be accomplished with an effective quality control system.

Controls Three Variables

According to A. C. Richmond, General Supervisor of Inspection Methods Research, in the Manufacturing Research Department from which point the program is being implemented the statistical quality control system checks and controls three variables in production operations: the operator, the machine and the material. Periodic checks on the accuracy of production parts tell when one of the variables needs correction. The end results of the system are that a minimum number of scrap parts are produced, salvage operations are avoided, and uniform parts are produced to close tolerances.

"The company has benefited from the system in three ways," Richmond says. "First, product quality has been improved because more uniform parts are produced to closer tolerances. Second, material requirements have been cut because less material has to be fed to production lines to offset scrap losses. And last but not least, labor and materials that would have been invested in scrap parts and salvage operations are eliminated."

Benefits Increase Each Year

"Actually the system is paying off more for the company each year it is in operation. In 1951 the value of labor and material losses that were eliminated by the quality control program is estimated at $3,500,000."

Typical of the gains that IHC Divisions are achieving through quality control is the recouping of $250,000 worth of material and labor at the Indianapolis Engine Works on cast iron crankcases alone. Control of foundry and machine shop operations which cut scrap in the machine shop as much as 56% made this possible.

Vital Steel Saved

At the Wisconsin Steel Works, 2643 tons of steel have been saved in one year alone by closer control of the diameter of round and square bar stock, thickness of flats, etc.

Rejects on radiator swedging operation at the Melrose Park Works of the Industrial Power Division were cut from 71 per cent to 3 per cent with the aid of the quality control system.

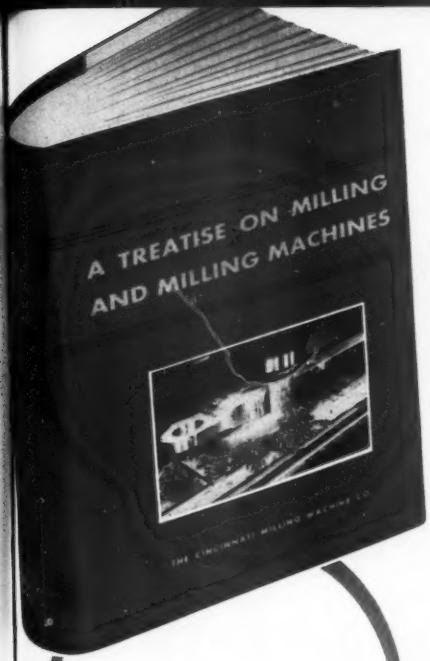
"Quality control methods are one way that manufacturing plants can up production without adding machine tools or speeding up production lines," Richmond says. "Our increase in product quality has been most encouraging, and what is more, we have found that in many cases our workers are highly enthusiastic about the operation of our quality control system."

How System Works

According to Richmond, the quality control methods International Harvester has applied work like this:

Accurate measurements of the dimen-

(Continued on page 76)



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3 Milling Cutters
4 Milling Cutter Materials
5 Milling Cutter Elements
6 Sharpening and Care of Milling Cutters
7 The Milling Process
8 Chip Formation, Surface Finish, and Cutting Fluids
9 Power Required in Milling
10 Mounting of Milling Cutters
11 The Milling Machine in Toolroom Work
12 The Use of Work Indexing in Repetitive Milling Operations
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ABC's of Trepanning

Trepanning, the idea of producing reasonably large holes by cutting a cylindrical groove and removing the center as a solid core, instead of removing all the metal within the ID in the form of chips, is at once one of the most modern and one of the oldest known methods of machining.

Certainly the Egyptians, at the height of their civilization, performed brain operations by cutting a disk out of the skull (which was replaced after the operation was completed).

It is only in recent years, apparently, that the principle has been applied to the machining of accurate bores in metals. Of particular interest at present is the application of the process to the drilling of gun barrels at a rate impossible with boring tools or conventional spade drills. A trepanning head used for this operation is shown in Figure 1.

by **Fred W. Lucht**
Development Engineer
Carboloy Department
of General Electric Company
Detroit, Michigan

Holes up to 30 or 40 feet or more in length, and up to 4½" diameter have been produced in steel forgings in this manner, and to tolerances of only a few thousandths as to concentricity and diameter.

The advantages of the process, however, are not confined to deep holes. The process may be applied equally well to producing of through holes in such parts as gear forgings, etc., thereby greatly reducing machining time. Accuracies in general will be better than when drilling, provided the equipment used is satisfactory.

In general the savings in time obtainable by deep-hole trepanning with carbides as compared with producing the same hole with high speed drills may run as high as 95%. Part of this saving, of course, is due to the higher cutting speeds and feed rates made possible by the carbide tip used on trepanning tools. However, the major part of the saving is still due to the simple fact that far less metal has to be removed in the form of chips.

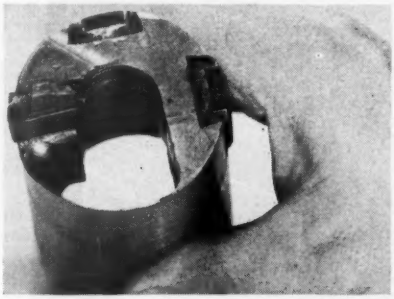


Fig. 1. A typical trepanning head used for the drilling of gun barrels. Holes up to 30 or 40 feet or more in length and up to 4½" in diameter have been drilled in steel forgings by the trepanning method with tolerances held to only a few thousandths as to concentricity and diameter.

Trepanning, of course, is a "natural" for carbides, for the following reasons:

1. The long life of the carbide insures continuity of cutting, as well as maintenance of closer tolerances as to diameter at the end of the bore as compared with the diameter at the beginning.

2. Higher cutting speeds and feed rates are possible with carbides.

3. The trepanning cutter body carrying the trepanning cutter blade must be protected against wear as it bears against the ID of the hole. Here again, carbide wear strips provide an excellent answer.

4. Proper carbide speeds can be obtained over cutting edge of a trepanning tool. (The dead center on a spadetype drill makes it unsuitable for carbides.)

To give an idea of the savings possible by trepanning instead of drilling, the following example may be of interest:

Work—18 ft. long, rough turned steel forging.

Hole—2-13/16" to be produced entire length.

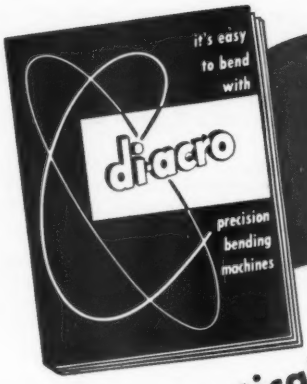
Feed—.008" per revolution.

Speed—550 sfpm (747 rpm) at outer edge of tool.

Accuracy—Hole held within .003" for size, and with .012" for alignment.

At the speed and feed used, total feed was 6" per minute, giving a total cutting

(Continued on page 78)



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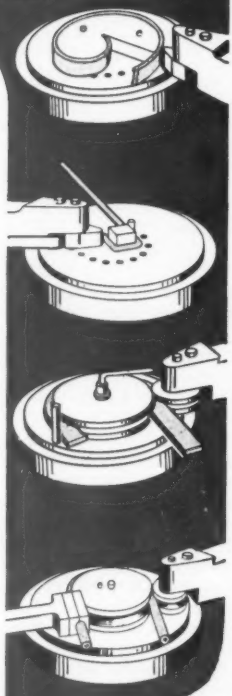

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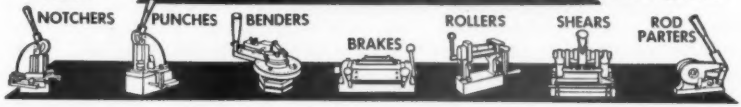

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . $10,000,000, from page 72

sions of a series of five consecutive pieces produced by a particular machine are taken. Then the quality control engineer uses statistical methods to determine the upper and lower limits of the particular dimension being produced. When parts are produced within these limits the production is said to be "in control". Charts showing the state of control of the operation are placed on the machine in full view of the operator. Thus the operator can easily see whether parts he is producing do meet the exacting quality requirements.

Operators Like System

In actual practice IHC has found that these statistical methods meet with the approval of the operator because he can see exactly where he stands on production accuracy. In fact it has found that often the machine or material rather than the operator is to blame for making scrap.

An interesting sidelight on the method is that the operator often makes more accurate parts by just putting his operation under control. The quality control charts provided for him let him see with his own eyes how he is doing. These charts offer him a challenge, not of production speedup, but of producing better parts with minimum scrap.

In addition to controlling production accuracy of specific machines, quality control engineers at International Harvester have utilized their methods to spot machines in a battery that do not produce parts of required accuracy. They then have the alternative of either repairing the machine or putting it on another production operation where less stringent accuracy is required.

Another advantage of this precision control method is that the statistical checks can actually predict when parts will be produced that will not meet specifications, thus permitting corrective measures to be taken before scrap pieces are made.

In one foundry, mold hardness, core hardness and pouring temperatures together with several other operations are controlled with the result that scrap has been cut 32.5%. Controls on machining operations on a crankcase resulted in an improvement of 47% in rework and 56% in scrap.

Another interesting example of increased accuracy achieved by the system is at the Melrose Park Works of the Industrial Power Division. Here tolerance range on a boring operation was cut in half by replacing a boring bar having two carbide-tipped tools with a two step six-flute carbide-tipped inserted blade reamer.

Here are some other typical examples of results achieved at many International Harvester Works through quality control methods:

Melrose Park Works. Soldering radiator side channels: Rejects cut from 54.3% to 1.5%. Precombustion chamber: Change in materials handling method cut rejects from 24.95 to 2.7%.

West Pullman Works. Screw machine ball bearing race turning operation: Study of rejects produced by each of a battery of machines obsoleted a machine in a 28-battery line because of its inability to produce accurate parts. By checking each machine individually and correcting its faults, rejections were reduced 54.6%.

Canton Works. The ratio of rework labor to direct labor was cut from 37% to 11% in 3 years on plowshares.

Tractor Works. On a track roller shaft grinding operation rejects were reduced from 8½% to 1%.

Louisville Works. Savings of $33,000 per year were achieved in the grinding room as a result of studies of stock removal, grinding methods and new measuring equipment on gear hobs.

Motor Truck Service Department. Errors in order filling were cut in half in two years by quality control system.

Hamilton Works. Cast fertilizer feed wheel: Scrap cut from 42% to 3%.

Milwaukee Works. Cast iron thermostat housing design changed as result of analysis of cracked castings. Thickened section cut rejects from 19% to 0.

Evansville Works. Plating of cotton picker spindles: Rejects reduced from 14.2 to 2%.

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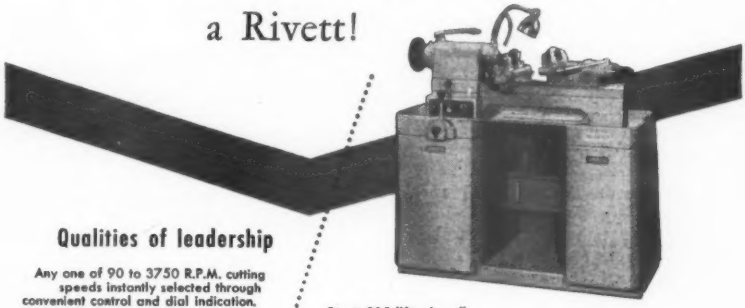

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time of only 36 minutes. This compared with an established drilling time of 15 hours when using high speed steel spade drills including time required for three drill changes.

At the present time there are few machines built in this country which were designed specifically for trepanning work. However, it is entirely feasible to convert existing deep hole boring machines or lathes to such work. Figure 2 diagrammatically illustrates a typical conversion.

Chief requirements of a trepanning machine are:

1. Adequate motor horsepower. In the example above, 46 hp was required. Sixty hp or more is usually desirable for good performance, depending on hole size and material.

2. An oil pump capable of delivering 25 gallons per minute or more, at a pressure of at least 175 psi was required for the above-mentioned job. The volume of oil required will vary, of course, with the hole size.

3. A carriage fixture to support and permit accurate feed of the tube on which the trepanning tool is mounted.

4. An oil inductor bushing and support which also provides an oil seal at the entrance end of the bore.

5. Steady rests to support the work.

6. Centralization of all electrical controls and indicators at or near point of chip outlet.

7. Variable speed control for the motor.

8. Gearless headstock.

9. Cutting fluid temperature and oil pressure gages.

Horsepower requirements, of course, are governed by rate of chip removal. The high power required is due to the ability of the carbide to remove chips so rapidly.

While 175 psi is given here as a minimum for oil pressure, higher psi values are frequently desirable. Much work has been done already in trepanning at pressures as high as 200 to 400 psi. The higher pressures, of course, require better oil seals.

There are several reasons for the high oil pressures required. First, the cutting fluid must effectively wash out the chips as rapidly as they are formed. A sufficient supply of cutting fluid must also flow rapidly enough to prevent any marked rise in either cutting fluid or work temperature. Last but not least, the cutting fluid must provide adequate lubrication and cooling for the carbide wear strips. A cutting fluid with a 10% sulphur base seems to be quite popular for this type of work.

Uniform control of tool feed presupposed the use of accurate lead screws to feed the tool into the work as the work revolves. If a machine considered for adaptation to trepanning has been used

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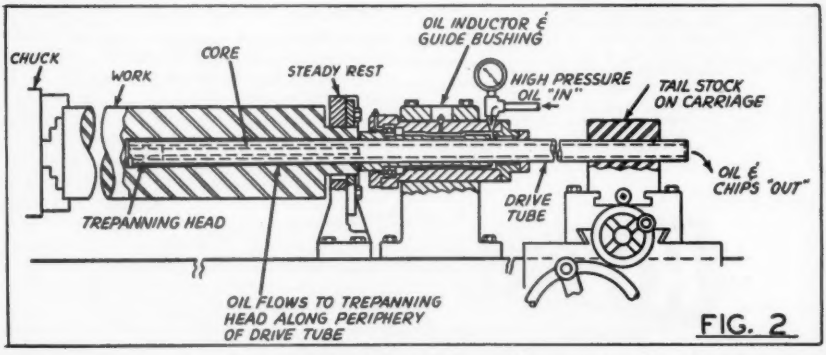

Fig. 2. Diagrammatic outline of a deep-hole boring machine converted for trepanning work. Adequate motor horsepower is required to give good performance. Sixty horsepower or more is usually desirable, depending on hole size and material. An oil pump capable of delivering 25 gallons per minute or more at a pressure of at least 175 psi would be required for the machine illustrated.

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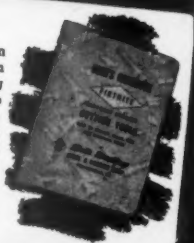

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Industrial Standards for Defense Production*

The subject "Industrial Standards for Defense Production" is a pretty broad subject to try to cover in a few minutes. Actually it would take far more time than we have at our disposal to discuss adequately any one particular phase of it. And also for the purpose of opening some avenues for questions and further discussion, I should like to relay here some random impressions on the subject that have occurred to me in connection with our defense work during World War II and the present emergency.

by **William C. Newberg**
President, Dodge Division
Chrysler Corporation

There is little need for me to go into detail here on the advantages of pursuing a sound program of standardization and simplification of military equipment and parts. Whether it be in rolling equipment, guns, ships or aircraft, I think we all recognize the value of maintaining a maximum degree of interchangeability of parts, from the industrial standpoint of sustained volume, manufacture and economy as well as the military standpoint of transportation, storage, and maintenance. I know the military men here can tell you a great deal more about this end of the subject than I can.

This job of standardization is a never-ending one. We only make a dent in the problem of the reciprocating engine when a whole new field is opened up with jet engines. We think we are beginning to understand high explosives and their limits, when someone starts exploding atoms.

It's like a company of soldiers holding the town hall, and then spreading out to take the whole town, and finally moving out from there to take the whole country. As the area they control expands, the borders they must protect expand accordingly. The problem is the same in technological development. As we increase the area of our knowledge, we also widen the borders of our ignorance.

But as big and important as the job of standardization is, those who are specializing in that job must be on constant guard against pursuing standardization for its own sake. A standard at best represents the ceiling point of development attained at the time of adoption. If thereafter everything different is to be thrown out because it does not conform, the inevitable result will be to stifle initiative and stop progress.

Over the years the automobile industry has had a great deal of experience with standardization and has developed many techniques for maintaining standards without interfering with technological advances. To take one example, you might be interested in hearing how Chrysler Corporation handles this particular problem in its civilian operations with regard to service parts for past models.

At the present time there are between nine and ten million Chrysler-built vehicles in use in the United States, comprised of approximately 1,000 different models, dating back to the first Chrysler models built in 1924. Helping to keep these cars in operation is a very important part of our work, and that means supplying repair parts as they are needed.

One of the things we do to this end is

(Continued on page 84)

*An address presented by Mr. Newberg at the session sponsored by the American Ordnance Association on "Industrial Standards for Defense Production" at the Second National Standardization Conference of the American Standards Association. Mr. Newberg, president of the Dodge Division, has been associated with the Chrysler Corporation since 1935. He has been successively chief engineer of Dodge's B-29 engine plant, president of Chrysler's Airtemp Division, and vice-president of the Dodge Division.

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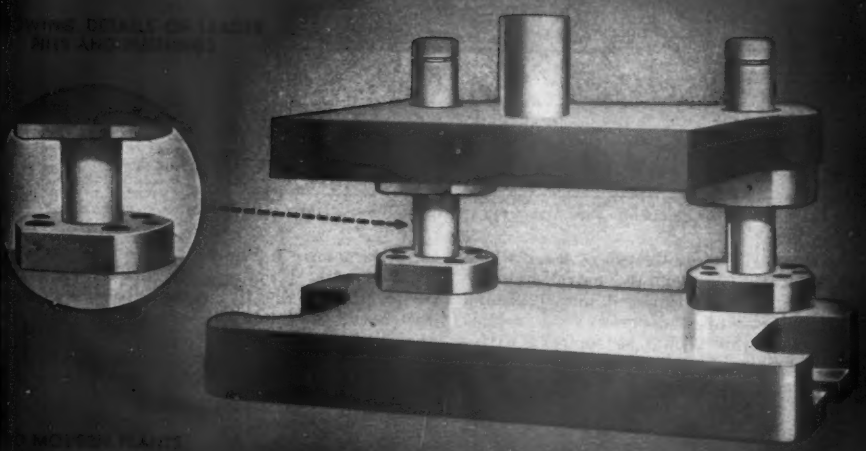

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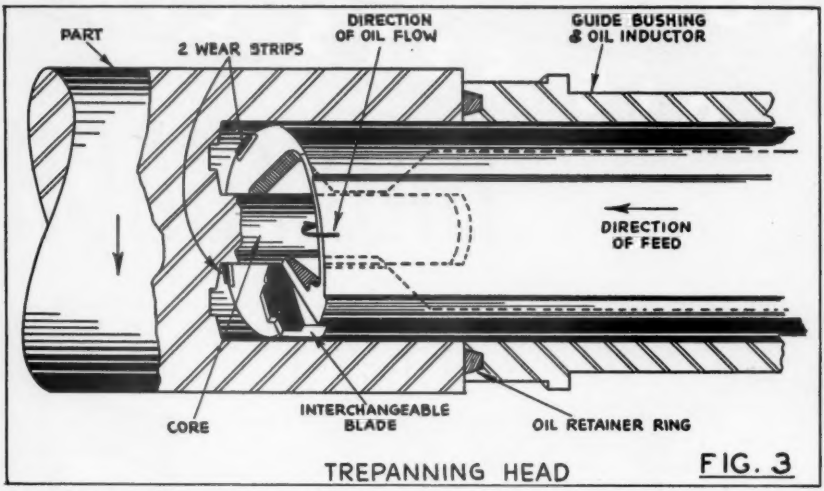

Fig. 3. Cut-away diagrammatic sketch showing trepanning head slightly retracted after starting a cut.

a great deal for one length of work which required the carriage to move over the same place many times, it may be found that because of lead screw wear in this spot the screw should be replaced to insure uniform feed over the entire travel of the carriage.

Trepanning Cutter

The trepanning cutter head, Figure 3, is attached to the non-revolving drive tube. Two types of cutter blades are currently used, a ¾" wide cutter blade for holes 1¾" up to as large as 8"; cutter blades 1¼" wide have been successfully applied to trepanning of large sized bores. Selection of cutter blade size depends considerably on operating conditions and horsepower available. With the ¾" cutter blade, oil is fed under pressure to the cutter head through the space between the drive tube and the ID of the tube and the core. With the larger cutter blade, the flow is reversed, since it has been found that discharge of the cutting fluid and chips around the periphery of the drive tube is advisable when trepanning larger holes.

A typical cutter head used for holes 8" for less in diameter and employing a ¾" blade is shown in Figure 3. Note that the carbide cutter blade and the carbide wear strips project slightly beyond the OD of the head, providing a passage for the coolant to the cutting area.

Figure 4 shows the detail design found to be most satisfactory so far for ¾" wide cutter blades. Since chips must be broken up as small as possible for ready washing out by the cutting fluid, the cutter blade has three distinct cutting edges so that three separate chips are produced. The center portion of the cutting edge "leads" and the two sides follow. Each cutting edge portion has its own step type chip breaker to break up the chips formed by that portion. Grade 78 has been found satisfactory for the tip for trepanning any steel within a 200-40 Brinell hardness range.

Best material for the wear strips appears to be grade 78. Best cutting speeds range from about 600 sfpm for steels in the 200-250 Brinell range to approximately 400 sfpm for those up to 400 Brinell. These speeds are for the outside edge of the blade.

Feeds of .006" to .010" per revolution have been found to work very well but

(Continued on page 86)

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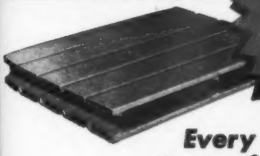

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One of the convenient uses of the box is on a steel stand. Door opens to any set angle by means of the chain, simplifying parts disposal by standing or sitting workmen. Built to dimensions and load capacity specified by the customer, including underneath clearance. Crane lugs, stacking brackets, and color of paint desired may be specified.

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to maintain, in an organization known as Service Engineering, an active study and interchangeability. Our objective is to secure interchangeability of parts and part assemblies without putting a freeze on progress. Service Engineering can never set aside an improvement. It has no veto power over new designs; at the most, it can call for consideration of alternate methods for obtaining a desired improvement without loss of interchanageabilty.

Its greatest opportunity for service is to consolidate groups of similar parts, to obtain a broad range of application over past models. The result of its operations has been great simplification of stock, reduction of inventory, and improvement of parts availability.

The cumulative effect of the group's work is shown by examination of the number of parts that no longer need be stocked. Of the many hundreds of categories that have been consolidated, selection of a random 20 will show that 5,000 items originally made are now being replaced by only 2,200 items. The aggregate effect, over all the types of parts that must be handled, lifts a tremendous burden from the business without any reduction in satisfaction given to the operator of the vehicle.

Of course, the military problems are far more complete than those of a single concern and the Military must operate under far more difficult circumstances. An industrial technique cannot always be lifted in one piece and transferred to a military application. But I bring up this one phase of our service parts activities to demonstrate that interchangeability and the consequent benefits can be attained without sacrifice of progress.

A standard is a tool, a means to an end, not an end in itself. As I see it, there are three basic factors to be considered in every proposed piece of military equipment.

Number one is performance. Will the tank or the plane or the gun do the job intended for it?

Number two is production. Can it be built and delivered in the quantities necessary for its use to be effective? Are there enough materials, tools, and skilled workers available to make the item?

Number three is maintenance. Once we build the item and get it in the field, can we keep it in operation?

Any standard that is adpoted to further one of these three considerations must be carefully weighed for its effect upon the other two. For example, standards must be realistic from a manufacturing standpoint. Without sacrificing performance, standards from the design stage, must be set with an eye on the manufacturing problem, the availability of tools and skilled manpower. In time of war, when manpower is short and when you must husband your skilled workmen for the close-tolerance work where it really is necessary, it is just common sense to allow maximum tolerances where the function of the part is not impaired.

Let me illustrate what I mean. During World War II I was assigned to the Dodge-Chicago plant where we built engines for the B-29 bomber. The problem of meeting aircraft specifications and maintaining volume output there was complicated by the fact that it is fairly common practice in the aircraft industry to specify closer tolerances for all surfaces and dimensions of engine parts than are necessary for successful operation of the engine. This is done to maintain workmanship at a high level. It's a device for continuous training and disciplined craftsmanship. And I imagine it's a perfectly good device when you're dealing with relatively low production rates and have skilled workmen to start with.

But at Dodge-Chicago we were not dealing with low production rates. In a brief two years, that plant turned out more than 18,000 B-29 engines. Each engine contained about 17,000 parts, and the majority of these were made right at that plant. Some of these parts carried from 50 to 100 specifications as to dimensions at various points, metallurgical content, surface finish, and the like. And in two years, something like 31 million parts were made and assembled into a powerful precision aircraft engine at Dodge-Chicago, by workers recruited at the height of the manpower shortage.

You can imagine what a problem was caused by trying to adhere to specifications which in their total were far more rigid than were necessary. The problem was made even more difficult by the fact that

(Continued on page 168)

Tank turret openings are rapidly machined by Turchan Follower attachment without the necessity of specially built equipment or skilled help, to accuracies well within the required limits. In this application the tracer handles 360° control with hydraulic drives attached to the vertical and cross feeds. Once the milling is started the tracer follows the template and automatically controls movement of the cutting tool, requiring attention only when the tool reaches a corner. Any type of standard boring mill can be similarly equipped. There are also Turchan Followers for planers, shapers, lathes and grinders. Tell us your problems.

Turchan puts standard boring mill on automatic basis to produce wider range of work, faster and better for armament needs.

Turchan FOLLOWER MACHINE CO.

OLDEST MANUFACTURER OF HYDRAULIC ATTACHMENTS FOR MACHINE TOOLS

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . ABC's, from page 82

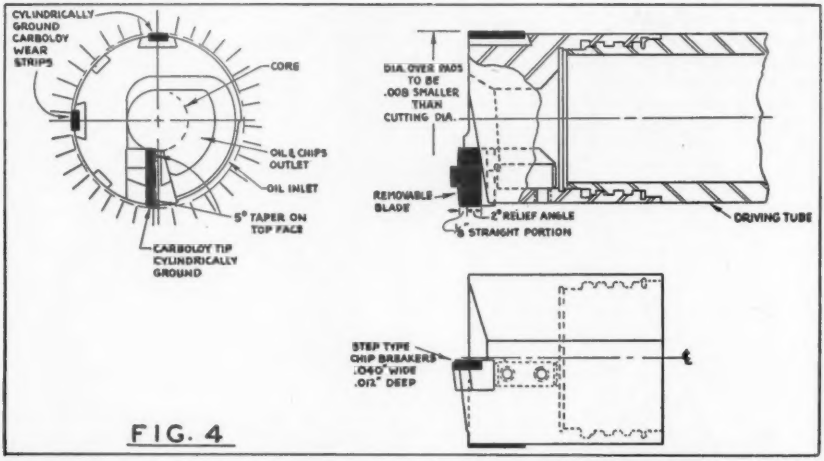


Fig. 4. Demensional sketch showing specifications found important to date in successful trepanning operations.

best feeds for each type of job may require some modification. The important thing is to produce a fairly heavy chip. This reduces cutter blade wear. The chips however, should be broken up until they are small enough to pass freely through the discharge space as indicated in Figure 5. Feed should not be reduced if speed is increased or vice versa. In some instances, although the chips theoretically may be small enough for easy passage, the coolant pressure must be increased to flush them out properly. This is especialy true when nearing the end of extremely deep holes.

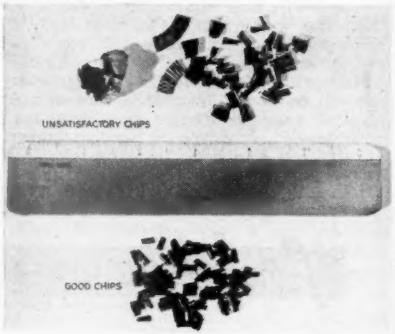
It is important that the correct cutter blade grind be secured right at the start. Wear strips are cylindrically ground in position before inserting the blade. The cutter blade is also cylindrically ground to a slightly larger diameter, as shown in Figure 4, after it is assembled in place.

Chip breaker size should not be changed when speed is changed. The size shown in Figure 4 has been found to be satisfactory in most applications.

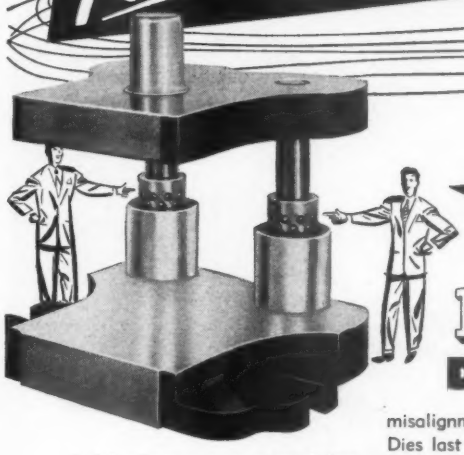
Trepanning speed depends on the material being machined, of course. With materials of 275 or 375 Brinell, cutting speeds of 500 to 600 sfpm (at bore diameter) have been found to work well. Somewhat higher speeds may be used for materials of lower hardness.

In some cases trouble has been experienced from extremely fine particles carrying through the conventional filter. Use of a special filter employing Carboloy permanent magnets has been found helpful in such cases by keeping these chips from getting into the pump where they can cause fairly rapid wear.

Fig. 5. Chips produced in trepanning should be well broken up and as near uniform in size as possible. Good chips are shown at the bottom. Unsatisfactory chips are shown at the top. Chip breaker design is particularly important in trepanning work.



FORGET LUBRICATION TROUBLES!



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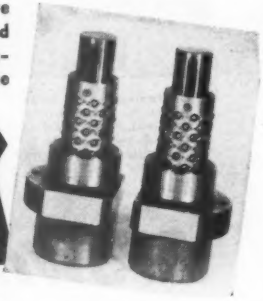
A dab of cup grease at regrinding time lubricates pins and bushings for hundreds of thousands of strokes without further attention.

No frozen bushings, scored pins, pulled shanks or die damage due to misalignment or faulty lubrication. Dies last longer, (reported as high as 185% more pieces between grinds,) close more accurately, produce pieces with cleaner edges and less scrap. For literature, write to Lempco Products (Industrial Division), Bedford, Ohio.

One way of keeping the cost down is to achieve production performances as yielded by these pins and bushings in Lempco Die Sets—1700 strokes per minute for over 2½ years—a remarkable performance record.

Actual photograph of pins and bushings after 500,000,000 strokes



DIEMAKERS Save 15 minutes out of every 60 minutes in die assembly — specify LEMPCO DIE SETS

LEMPCO PRODUCTS, INC.
INDUSTRIAL DIVISION BEDFORD, OHIO

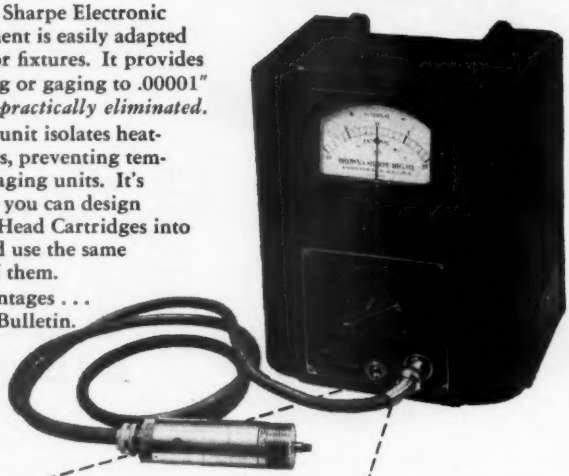
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Build *"tenths of tenths"* measuring into your equipment

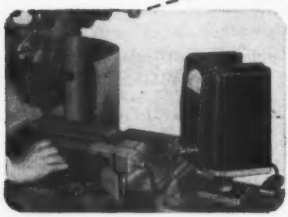
Versatile Brown & Sharpe Electronic Measuring Equipment is easily adapted to your machines or fixtures. It provides fast, accurate setting or gaging to .00001" *with human error practically eliminated.* Separate amplifier unit isolates heat-producing elements, preventing temperature drift in gaging units. It's economical, too — you can design inexpensive Gage Head Cartridges into several fixtures and use the same amplifier for all of them.

Learn all the advantages . . . write for detailed Bulletin.

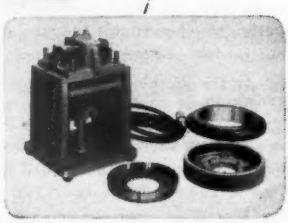
Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



Brown & Sharpe Electronic Amplifier No. 950 for .0001" to .00001" readings. Gage Head Cartridge No. 953 is plugged in.



Electralign — an application on Brown & Sharpe's own grinding machines. Permits fast, accurate setting of swivel table for grinding of straight work or exact tapers . . . after a single trial grind.



Special fixture utilizes Gage Head Cartridge and Amplifier to measure internal angle accuracy to ± 1½ seconds independently of bore size and without reference to locating surface.

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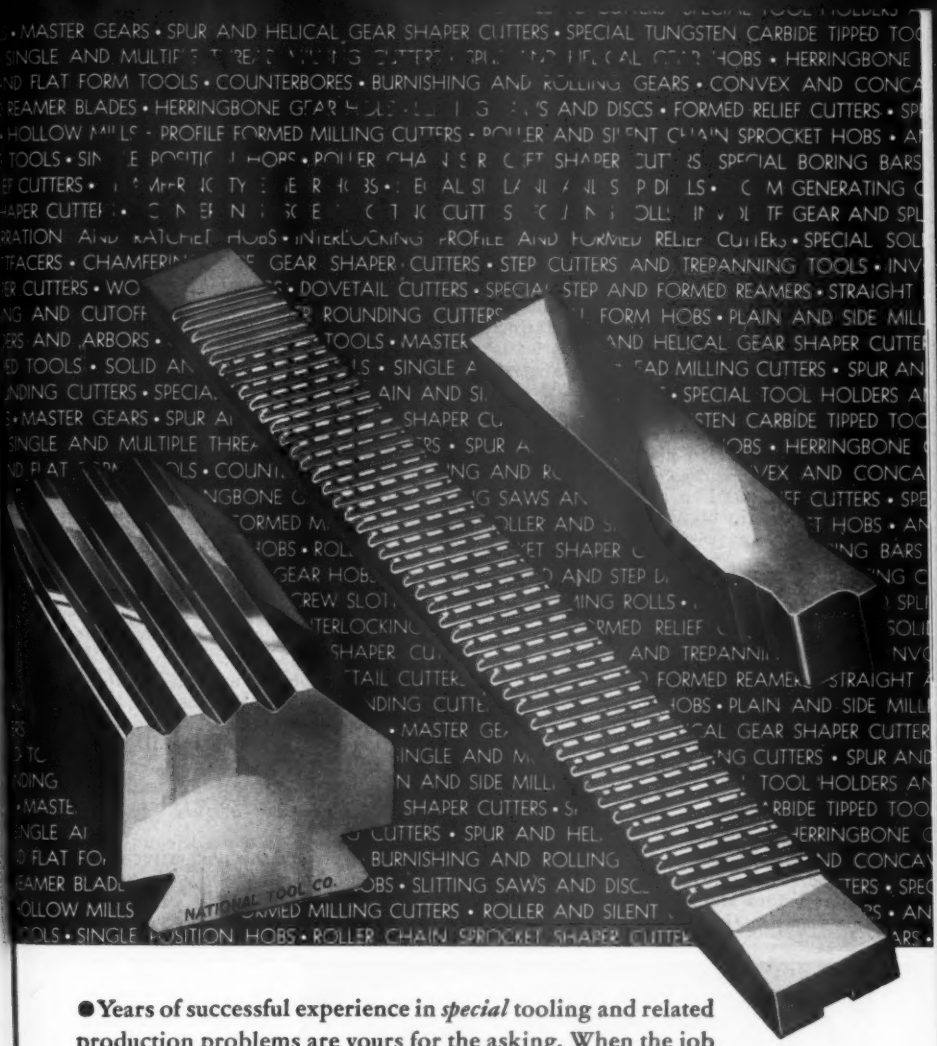

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Machining Molded Nylon Parts

by C. W. Kalb
Master Mechanic
NEW PROCESS GEAR CORPORATION
Syracuse, N. Y.

To date very little information has been made available on the machining of parts made of solid nylon. This material is finding an increasing use for cams and non-continuous bearings in light machinery since nylon will operate satisfactorily over long periods without any lubrication.

On the other hand, nylon has several characteristics which make it difficult to machine. Since the material is quite flexible, care must be taken not to distort the parts either in clamping or through undue tool pressure.

The material like many other plastics is also quite abrasive, thus normally creating a tool wear problem. Having a low melting point, it is necessary that the parts not be overheated during cutting.

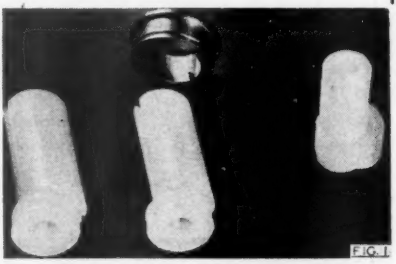

Fig. 1. Nylon parts in which through holes with inverted keys are sized by a broach and machine setup. The eccentric stitch control cam is shown before machining (left) and after machining (right) with its mating steel part.

Of interest therefore are machining operations on several nylon parts used in sewing machines produced by New Process Gear Company.

The part shown in Figure 1 is an eccentric stitch control cam shown left and center before and after machining. With this cam (mating steel part is shown in back of finished cam) length of the stitch in a swing machine can be infinitely varied and even reversed while the sewing machine is running.

The part is plastic molded, but for the precision required by New Process, it must be subsequently machined. Figure 3 shows the fixture for broaching the ID and inverted key.

An idea of the difficulty in tooling the operation may be gleaned from the following:

1. When gaging the part after broaching, it must be supported endwise. Any pressure on the sidewalls would cause

(Continued on page 94)

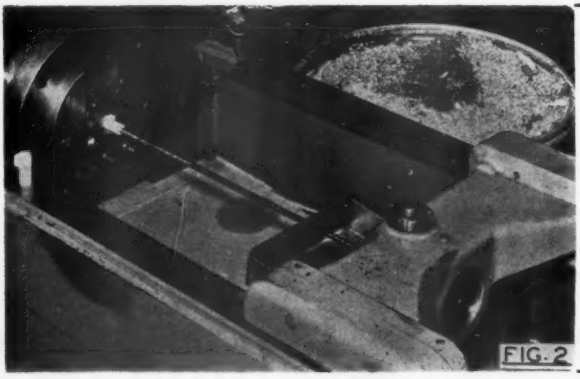

Fig. 2. A closeup of the broaching operation. The nylon part being broached is the one shown at the right in Fig. 1. The cam is loaded into the locating fixture on the face plate of the broaching machine. The fixture has two adjusting screws for moving the cam in relation to the keyway during the machine setup. A progressive broach is used together with a broach follower to guide the broach and avoid drift.

Photos courtesy
Colonial Broach Co.

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THE *Hamilton* TOOL COMPANY
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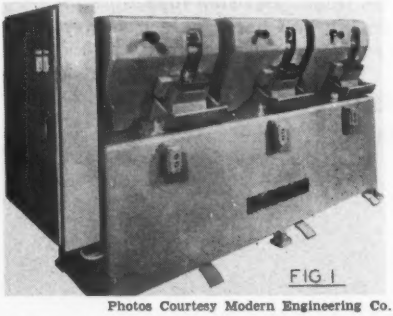
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Chamfering Hypoid Pinions

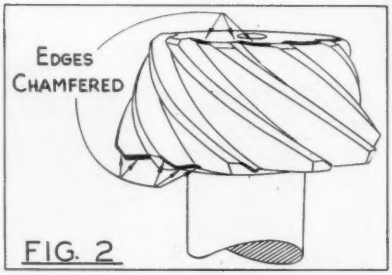
A completely new line of burring and chamfering machines for deburring hypoid pinion teeth has been announced by Modern Industrial Engineering Company. The machines embody a considerable number of advanced features on which patents have been applied for, including the following:

1. Simultaneous chamfering on the acute side and removal of burrs and sharp edges on the profile and considerable part of root on both toe and heel of all teeth as well as peripheral chamfer on large end. (See Fig. 2)
2. Output rate up to 300 complete hypoid pinions per hour per station per machine.
3. Foolproof. Complete elimination of skill on the part of the operator. No prelocating by operator.
4. Push-button simplicity of operation with safety interlocks; automatic gaging.
5. Minimum down-time by use of extremely long-life tooling.
6. Universal character due to simple change-over for pinions of different tooth numbers and diameters.
7. No coolant required.
8. Hydraulic and air mechanisms eliminated.
9. Minimum loading time. Clamping time and clamping are eliminated.



Photos Courtesy Modern Engineering Co.

Shown in Fig. 1 is the Model 2041, a three station Burr-Master for simultaneous chamfering of as many as three different hypoid pinions of different dimensions—one in each station. The three stations are identical except for detail tooling assemblies and ratio of quickly accessible change gears.



Particularly noteworthy on the Burr-Master is the quality of the chamfer produced. Since this chamfer is generated uniformly, it eliminates all sharp corners well down into the root of the tooth.

Each station is independently operated. The operator merely places a hypoid pinion—shaft end down—into the opening provided and throws the drive lever to start the cycle. An oversize pinion will not drop in all the way. An undersize pinion or a pinion with the wrong number of teeth will not permit the automatic gaging device to start the cycle. Thus the machine protects the operator against errors.

As soon as the cutting cycle has been completed—a matter of only 4 seconds—the "cycle indicator light" goes on. The operator then pulls the release handle (shown above and to the left of each station) and steps on the ejector pedal. Depressing this pedal while the machine is still running (before the cycle is completed) will not eject the part due to a safety interlock.

Fixtures may be readily interchanged as complete assemblies to set up any station for a different pinion. Radial adjustment of the part in relation to cutters is provided.

The fixture plate itself acts as part of an automatic gaging device. Built into the lower side of the fixture plate is an automatic electric gaging device with an electric interlock with the machine cycle which prevents the machine from starting if the pinion is of the wrong size. This gaging device is adjustable to permit its being set to handle pinions with varying amount of stock on the OD within the range desired by the particular gear producer.

Eliminate Secondary Operations —— Reduce Costs

Blanking*

Piercing*

Trimming*

Swaging*

Coining*

Forming*

*Produce parts requiring any or all of these operations complete at one stroke of the U. S. Multi-Slide ®

To meet competition today manufacturers must closely control costs. Secondary operations, inspections and handlings must be eliminated wherever possible. In the production of precision formed stampings from coil stock, the U. S. Multi-Slide ® can effect substantial savings because it completes a finished part at each stroke of the machine. Many different types of parts which would ordinarily require costly secondary operations can be profitably produced. An since parts are produced complete—uniformly and to close tolerances—the number of inspections is also reduced.

The illustration above shows a typical part which is produced complete in the No. 33 Multi-Slide. This machine has a capacity for material up to 2½" wide. If your program involves the production of precision stampings, investigate its labor-saving, time-saving features. Ask for a copy of Bulletin 15-T containing complete specifications.

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USP PRODUCTS

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

. . . Molded Nylon Parts, from page 90

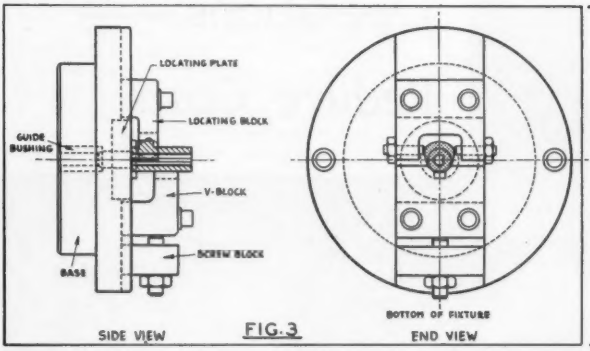


Fig. 3. A line drawing of the side and end view of the fixture for broaching the nylon eccentric stitch control cam. Note the bushing that guides the broach after it has passed through the work.

sufficient deflection to prevent entry of the 'go' gage.

2. Since the material is quite fibrous and spongy, it is quite easy for the broach to tend to drift.

In broaching the part, the cam is loaded into the locating fixtures on the face plate of the broaching machine. The fixture has two adjusting screws for moving the cam in relation to the keyway during machine setup.

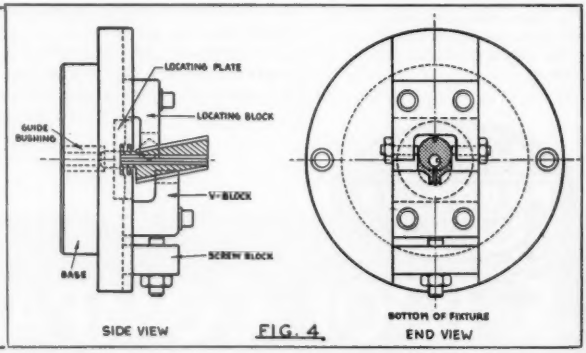
A progressive broach designed by Colonial Broach Company, is used together with a broach follower to guide broach and avoid drift. The first 11 teeth on the broach "rough" the hole, while the next 18 teeth "rough" the keyway. The last few teeth finish the keyway and size the hole. Step per broach tooth ranges from .001 to .003". Actually only about .010 inch of stock is removed per side. Limit on the ID is .002" while the keyway must be central with the bore within plus or minus .001 inches.

Broching speed is 18 ft. per minute (3.6 inches per second). Soapy water is used effectively as a coolant not only for broaching, but also for turning the ID which is done with high speed steel tools on a Lo-Swing lathe.

Life of broaches per grind is from 2,000 to 2,500 pieces, with an output of 144 pieces per hour, an excellent job considering the difficulties involved.

A second nylon part (at right in Figure 1) also has its ID and inverted key broached in the same fixture on the same Colonial machine (see Figures 2 and 4).

Fig. 4. A line drawing of the side and end view of the fixture while broaching the other nylon part shown in Fig. 1.

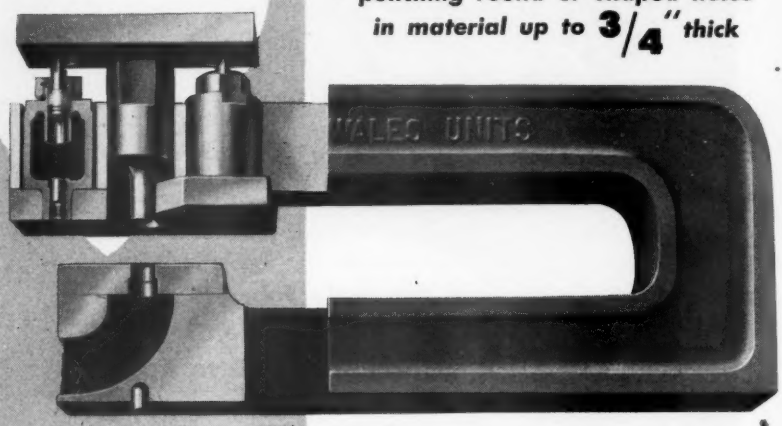


SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Announcing

WALES
HYDRA-SPRING UNITS
for
punching round or shaped holes in material up to 3/4" thick

Heart of Wales
Hydra-Spring Hole Punching Unit



Above cutaway view of Wales Hydra-Spring Hole Punching Unit shows two Wales Hydra-Springs (one on each side of the punch). The Hydra-Spring at left of the punch is a cross-section view.

A major *PROBLEM* in perforating sheet metal has been the stripping of thick material . . . not the punching. Wales Hydra-Springs *solve* this age old problem by providing many times more stripping pressure than mechanical springs of the same volume.

These *revolutionary* springs permit compact, self-contained, independent Wales Hole Punching Units to punch and *strip* material up to ¾" thick.

Such *outstanding performance* is the result of utilizing the compressibility of special fluids. Wales Hydra-Spring loads may be changed by a simple adjustment to increase or decrease the volume of fluid.

This is too big a story to tell in this space so WRITE TODAY for complete information on Wales Hydra-Spring Hole Punching Units.

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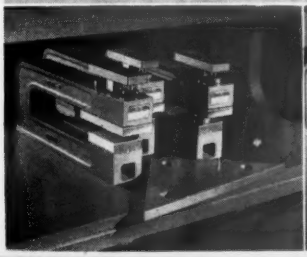
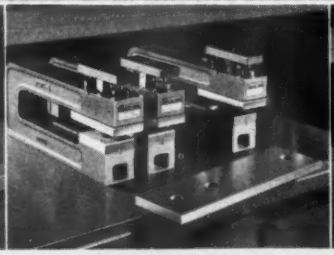
George F. Wales, *Chairman*
385 Payne Avenue, North Tonawanda, N. Y.
(Between Buffalo and Niagara Falls)
Wales-Strippit of Canada Ltd., Hamilton, Ontario
Specialists in Punching and Notching Equipment

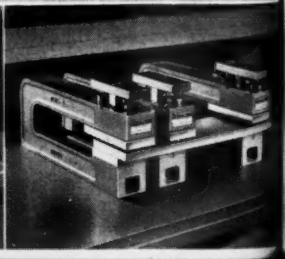
Showing a template setup of Wales Hydra-Spring Hole Punching Units in a press brake. Note the ¾" thick work in the foreground.

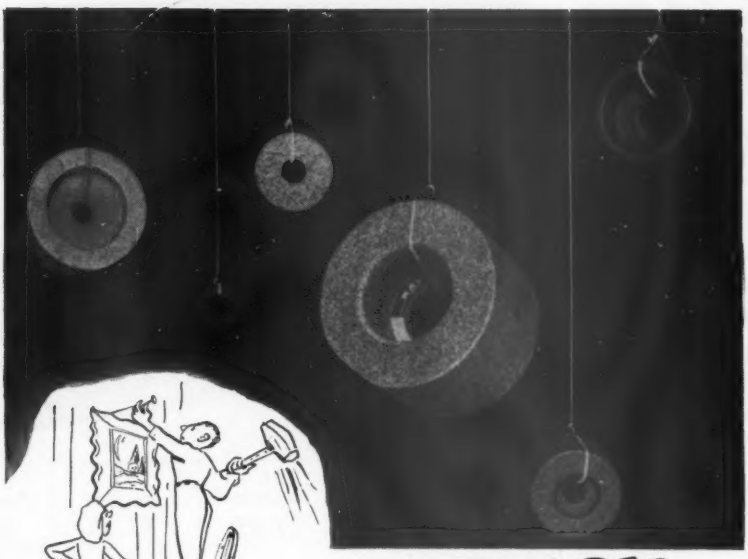


A straight line setup of the same group of Wales Hydra-Spring Units as shown at left with ¾" thick punched work in foreground. The only limitation of the number of holes punched in each operation is the capacity of the stamping press or press brake.



Showing the same setup of Wales Hydra-Spring Hole Punching Units as shown at left with work on top of dies ready to be punched. Note nothing is attached to press ram.





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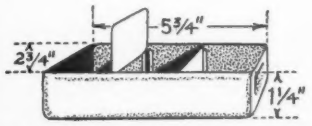

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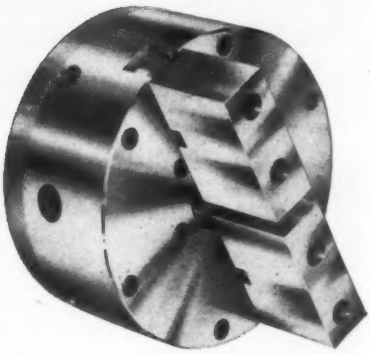

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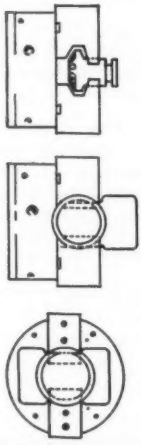


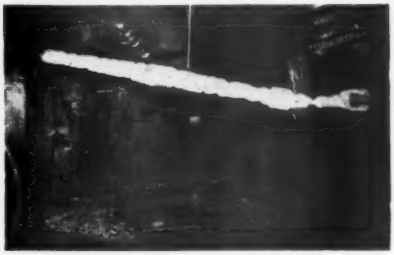
BUCK TOOL COMPANY
418 Schippers Lane
KALAMAZOO, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Forging Dies, from page 63

Fig. 7. Completed half-roller forgings on a roller type cooling conveyor. When cool, forgings go to another department where each pair is butt welded to form a track roll.

Fig. 8. Showing camshaft being removed from hammer after forging, ready for trim flash in adjoining press.



Flash is trimmed off in a press die immediately after forging, and a second impression in this die restrikes the forging, especially along the trim line. Each forging is then placed in a rack, Figure 9, made from a series of tubes about the length of the forgings so that it will cool without bending. It might be bent if forgings were piled or handled in bulk while still quite hot. When cooled, the

Fig. 9. Rack made from lengths of tubing to form compartment into each of which forgings are placed so that they will cool without the warping that might result if forgings were stacked while still hot and soft.

Fig. 11. Forging on the track frame guide is done in this hammer using a die that does forming operations.

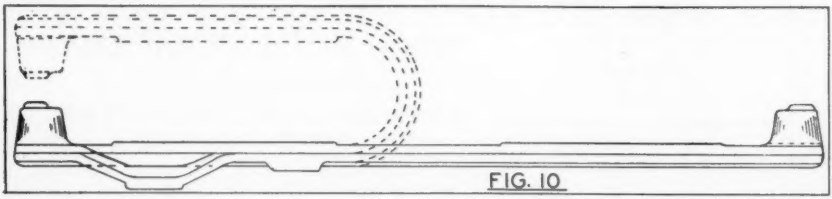
forgings are ready for transfer to heat treating. A helper is required at the hammer but 31.4 forgings are produced per hour. They weigh 38¼ lbs. each.

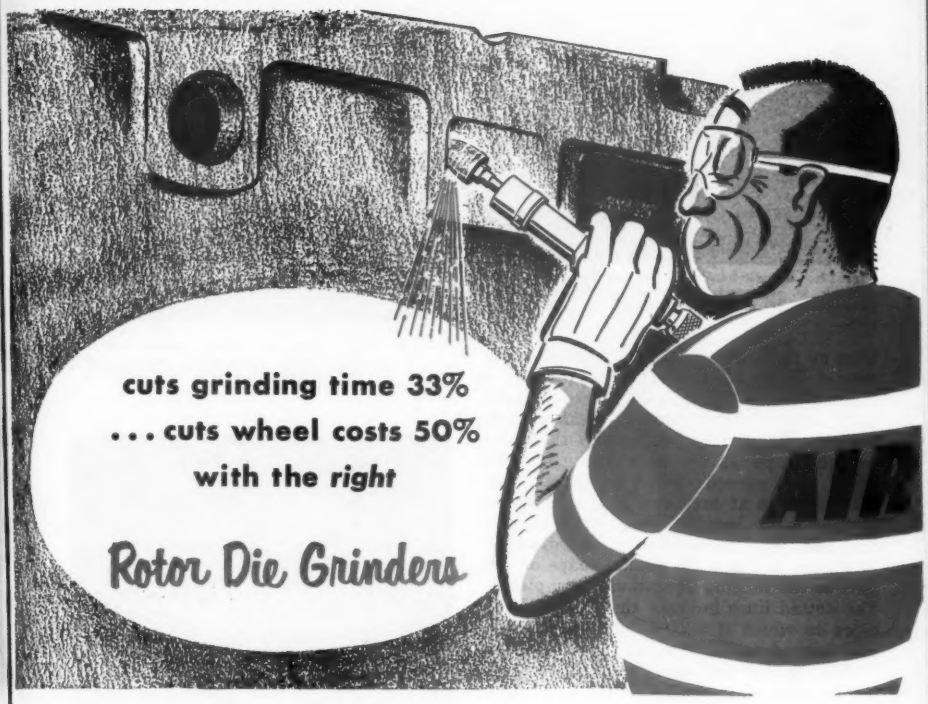
Forging Track Frame Guides

Among other forgings, one termed a track frame guide, Figure 10, is made from 4" round billets 14" long and weighing 63 lbs. each. These billets are heated to about 2250° F in a box furnace and

(Continued on page 102)

Fig. 10. Solid line drawing of track frame guide forgings shows how it appears before it is bent. Subsequent bending, indicated by dotted lines, is done in two operations. This gives the piece a U-shape and brings the end bosses nearly together for later arc welding.





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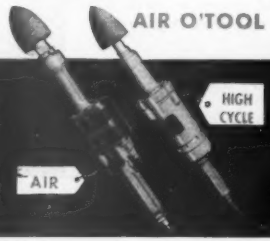


THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

. . . Forging Dies, from page 100

Fig. 12. Before bending, the track frame guide forging is reheated and restruck in the finish impression of this die to bring all sections to size.

then go to a 3000-lb. steam hammer using roughing dies to draw out and produce a tong hold. Reheating is then done to about 2260° F in a pusher furnace because much more work is required to convert the blank to the shape shown in Figure 10. The piece then exceeds 36⅝" in length, has a heavy boss at each end and is flattened to 8⅞" width besides being recessed near one end. The solid lines of the drawing in Figure 10 show the profile shape of the part as the forging operation is completed. The dotted lines indicate the shape of the piece to which it will be ultimately bent and formed for welding.

This second set of forging operations includes drawing in a fuller cavity to help distribute the metal, rolling for further distribution and shaping of sections and final striking to attain correct shape. All three are done in the die shown in Figure 11 in a 12,000-lb steam hammer. After trimming, the workpiece is restruck in the finish impression of the die, Figure 12,

(Continued on page 135)

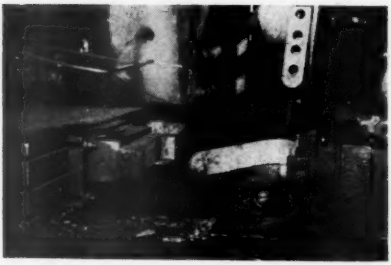
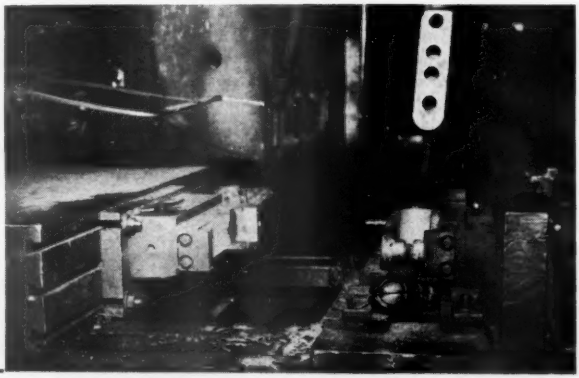


Fig. 13. After the track frame forging has been bent to V-shape in a press, it is placed in this bulldozer to complete the bend.

Fig. 15. After final forming in the bulldozer, the track frame forgings are clamped in this fixture to cool, so that end bosses will not draw farther apart.

Fig. 14. Forging as it appears at the end of the bulldozing operation that brings the end bosses so close together that they nearly touch.



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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

New Process Cracks Bottleneck in Turbojet Engine Blade Production

A new manufacturing process which will crack a bottleneck in the nation's aircraft turbojet engine production program has been announced by the General Electric Company.

Developed by the Company's Thomson Laboratory at Lynn, Mass., the process involves fabrication of the stationary, or stator, blades of jet compressors in place of the relatively slow and expensive forging technique currently used. At the left in Figure 1 is shown the fabricated type of blade. The other blade is the forged type.

In addition to greatly speeding up blade manufacture, C. W. LaPierre, manager of the G-E Aircraft Gas Turbine Division, said the process promises great savings in critical materials and millions of dollars annually in jet engine costs to the armed forces. Furthermore, blade fabrication will relieve pressure on the nation's forging facilities. Considerably less production equipment is needed for fabricated blades as compared to forged blades and the equipment is less costly than that used in forging.

Added to these advantages, cost reductions of 55 per cent in stator blade manufacture will be possible through fabrication. Details of the fabrication process, which cannot be revealed publicly for security reasons, will be made available through the USAF to other turbojet manufacturers in the nation.

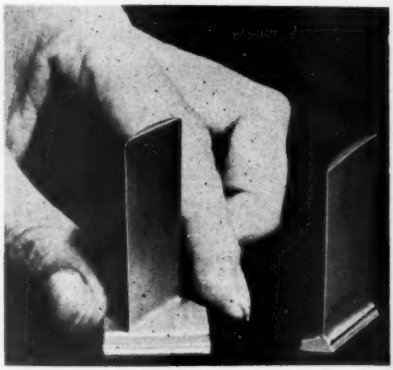

Fig. 1. A complete fabricated jet engine blade is shown at left. On the right is the forged blade currently used in production models of the General Electric J-47 engine. The fabricated process has been approved for production by the Air Force, for use in the stator, or stationary, portion of the compressor. G.E. is establishing production facilities at its Lockland, Ohio, jet center.

The critical material savings are estimated at 39 per cent because of virtually chipless production which reduces waste.

Fabrication is one of several methods of blade manufacture under investigation by the company as a substitute for forgings.

The compressor, regarded as the "heart" of a jet engine, is the many-bladed device which forces air in great quantities to the combustion chambers. It consists of a "rotor" and a "stator." The rotor is

(Continued on page 108)

Fig. 2. This close-up of the stator of a General Electric J-47 jet engine compressor shows how fabricated blades are simply inserted into place in slots in the compressor casing. The other blades shown here are forged. They have been inserted in a blade ring, and the rings in turn have been inserted into the casing slots.

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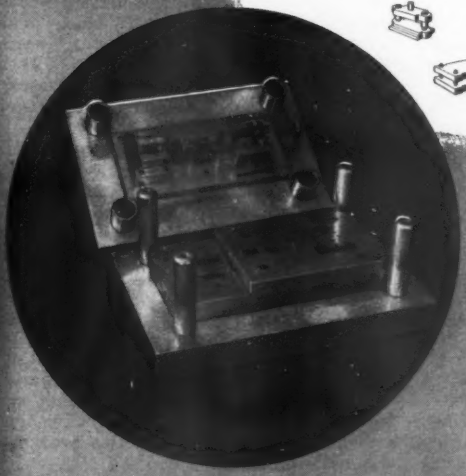

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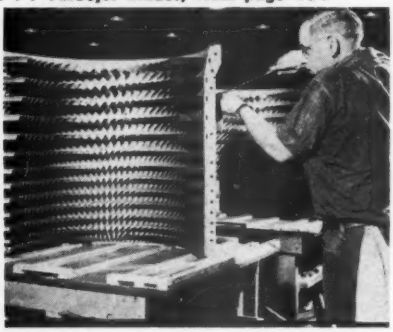

Fig. 3. This is the compressor stator of a General Electric J-47 jet engine. Each stator has hundreds of blades. The "rotor," the rotating portion of the compressor, also has hundreds of blades. Use of fabricated stator blades, instead of forged blades, will save the Air Force millions of dollars annually on one model alone of the several J-47 models produced by the company for the USAF.

cylindrical and has hundreds of blades affixed to its outer surface. Surrounding the rotor is the stator, which has hundreds of stationary blades. Figure 2 shows a close up of a stator in which both fabricated and forged blades are installed. This compares the assembly of the two types of blades. The stainles steel blades on both the rotor and stator are precision manufactured, with air foils similar to the air foil of the wing of an airplane. As the rotor turns, air is forced through the rotor and stator blades and compressed as it travels to the rear toward the combustion chambers.

Current J-47 production models, for instance, have approximately 2,000 compressor blades, more than half of which are on the stator. Figure 3 shows the arrangement of stationary blades in a stator assembly. The fabrication process has been approved for the stationary blades, while the rotary blades will continue for the present to be forged because of the high centrifugal stresses involved.

Under the precision forging process, the blade and its base are hammered from a single piece of stainless steel. The air foil is formed during the hammering process. The base is dove-tailed so as to fit into a "blade ring" and the rings holding the more than 1,000 stationary blades are pushed into slots in the compressor casing.

Anticipating that the forging process constitute a bottleneck to mass production, the Aircraft Gas Turbine Division three years ago handed the problem to metallurgists of the Thomson Laboratory at Lynn, Mass.

Their instructions were to determine whether blades could be manufactured without use of forging facilities, but still interchangeable with forged blades. Under the direction of G. B. Wilkes, Jr., laboratory engineer, investigation turned to a principle used for some time in steam turbine manufacture whereby the blades are rolled in long strips, contoured to the proper air foil, and then simply cut to the desired length during assembly.

The engineers found the process adaptable to turbojet manufacture. The base for the blade, which is an integral part of the forged blade, was a big problem. They spent two years in solving that before hitting upon a way of making a separate base having an opening therein so that the blade could be inserted and welded to it. The base is so shaped that it fills the same area as the present blade ring, thereby eliminating the ring and an expensive manufacturing and assembly process.

The design of the base is such that it provides even greater resistance against vibration that may occur due to occasionally uneven air flows through the compressor. The new blade is much more strongly fastened to the casing, which will minimize the damage caused by a foreign object entering the compressor. Both of these items contribute to longer and safer engine life.

Limited production of blades for engine testing was begun in late 1950 under F. A. Swan, planning supervisor for the Aircraft Gas Turbine Division.

Performance tests were run on two engines equipped with fabricated stator blades before any substitution was authorized. After 500 hour endurance tests, thorough examination showed no undesirable conditions or signs of future failure according to engineers. Performance tests showed no change in efficiency compared to engines with forged blades and one test showed a slight increase in efficiency, although the engineers said this probably was not significant.

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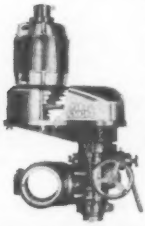

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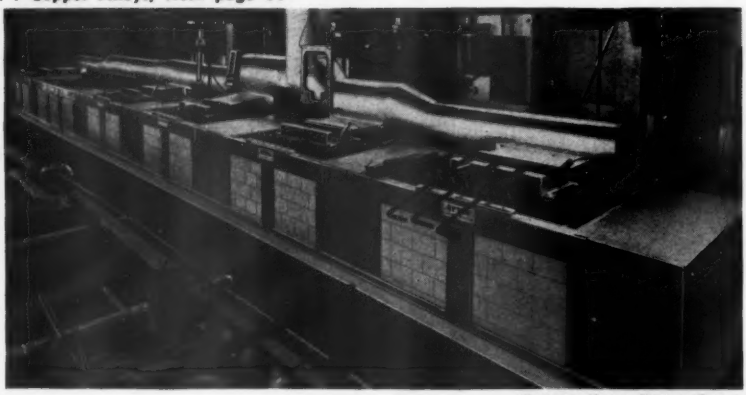

Courtesy Upton Electric Furnace Co.
Fig. 1. Battery of batch type furnaces utilizing molten salt in the annealing of cartridge brass.

better to set the furnace at the desired temperature and provide sufficient time for the load to be heated uniformly.

The use of a salt bath having immersed electrodes, Figure 1, is becoming quite popular in the heat treatment of the nonferrous metals and its application in the heat treatment of the copper base alloys is contingent on the specific composition to be annealed. Where this method is applicable, a uniform heating will be experienced; a temperature variation within the salt bath usually being less than 5 deg. Fahr.

This type of furnace can readily be placed on an automatic basis as is illustrated in Figure 2, thus realizing a considerable reduction in the time factor as compared to the conventional batch or continuous furnace design. In the brass mill, the bell type furnace such as illustrated in Figure 3 is usually preferred in the annealing of coil stock.

An operational procedure usually preceding either an annealing or heat treat operation is that of cleaning off the lubricant used to aid in the fabrication of the item, whether it be a drawn article, stamped part or a screw machine product. There are several methods of removal of soil, thus either emulsion cleaning, alkaline bath cleaning, solvent cleaning, degreasing or electrolytic cleaning may be employed; the method chosen depending upon the item, the method of manufacture, the choice of lubricant, etc.

Lubricants made from animal or vegetable oils or greases such as tallow, lard oil, palm oil and olive oil can usually be removed by a process known as saponification. This procedure consists of immersion of the parts in an alkaline solution where the oils react with the alkali to form water soluble soap compounds. The essentials in soil removal by this

(Continued on page 110)

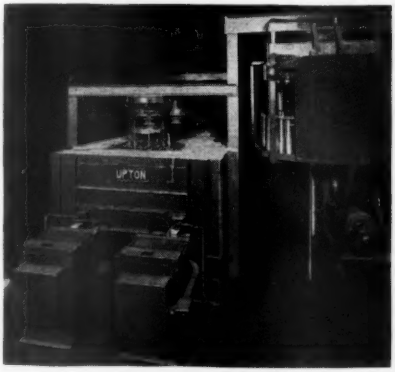

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Fig. 2. Conveyorized salt bath furnace used in the annealing of cartridge brass.

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Courtesy Bridgeport Brass Co.

Fig. 3. Typical bell type furnace installation used in the bright annealing of coiled strip stock. Notice protective jacket.

method would be a combination of heat, sufficient quantities of active chemicals and agitation whenever possible.

Caustic soda, soda ash, and causticized soda form the least expensive and most direct method of producing alkalinity within the cleaning bath. However, such materials, as a general rule, possess less surface activity than materials of more complex chemical structure such as the sodium metasilicates, tri-sodium phosphate or similar salts.

Unsaponifiable mineral oils such as kerosene, machine oil, cylinder oil and general lubricating oils are usually removed by an emulsifying procedure employing compounds containing soaps, wetting agents and dispersing mediums. Emulsifying cleaners are miscible with oils and can be washed off with water, but a slight film of oil may remain on the work which will necessitate a subsequent alkaline dip or spray treatment to obtain chemical cleanliness. Spray emulsion cleaning is of wide practice; the concentration being from ½ to 2 percent per gallon of water and the operating temperature usually being at 160 to 200 deg. Fahr. Stable emulsions are desired, and where the supply water may be slightly acidic the emulsion may break. To counter-act this undesirable effect, an addition of ½ to 1 ounce of mild alkali per gallon of water can be made to the cleaner tank.

Solvent cleaning is used to a considerable extent in the removal of cutting oils from screw machine products; the procedure merely consisting of immersing the parts in a suitable solvent at room temperature. Vapor degreasing methods are used when a quick method for the removal of soil is desired. In this method, the solvent vapor, usually a chlorinated hydrocarbon, condenses on the article to be cleaned with the condensate washing away the oily coating, leaving the pieces dry and clean.

The low surface tension exhibited by the solvents enables this process to remove oil from surfaces in close contact far more efficiently than any other known cleaning method. However, specialized equipment is required and the cost factor must be carefully determined in relationship with the production requirements and the type of soil to be removed. Equipment can be obtained that is operable either by hand or on a continuous mechanized basis.

In the electrolytic method of cleaning, alkaline materials are normally used; the alkalinity balance being such that a high electrical conductivity is realized. The bath temperature should be as near the boiling point as is permissible without producing excessive tarnish on the parts immersed. Cathodic cleaning is preferred over anodic cleaning due to the greater speed realized. In this procedure, the

(Continued on page 112)

2 New Toolroom Aces

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work cleaned is the cathode and the gas evolved during the electrolytic action will tend to lift the soil, thus presenting a clean surface for subsequent operations.

The use of a protective atmosphere during furnace annealing is highly recommended; the resultant work being bright. The savings realized in both time and the elimination of costly operational procedures such as pickling will more than compensate for the cost of additional equipment to produce this atmosphere. This is especially true where high production is the rule rather than the exception.

Copper is one of the easiest of metals to bright anneal; the protective furnace atmosphere utilized being generally a completely burned fuel gas with both the hydrogen sulfide and the sulfur dioxide removed by auxiliary scrubbing towers.

A precaution to observe in the annealing of electrolytic "tough-pitch" copper is the avoidance of an atmosphere which contains reducing constituents such as hydrogen or certain hydrocarbons, otherwise an inter-crystalline embrittlement such as illustrated in Figure 4 will result. This embrittlement, caused by the reaction of the reducing gases on cuprous oxide within the metal, may cause the surface of the metal to open up in a series of fissures when stretched or bent.

Alloys containing zinc such as the brass compositions are more difficult to bright anneal; this difficulty increasing as the zinc content of the alloy increases. This difficulty is traced to the oxidation and evaporation of the zinc from the alloy leaving the surface rough, etched and coppery in color.

The most suitable atmosphere for the annealing of brass or other zinc bearing alloys is either an inert nitrogen atmosphere, or an active reducing gas such as hydrogen or hydrogen-generating constituents like the decomposition products of menthanol or other hydrocarbons. Both are rather expensive, and in many instances in commercial applications these alloys are annealed to produce a slight oxidation which is easily removed by a flash pickle. The resulting surface is commonly referred to as a "clean anneal".

The nickel-silver alloys are the most difficult to bright anneal; the higher

(Continued on page 114)

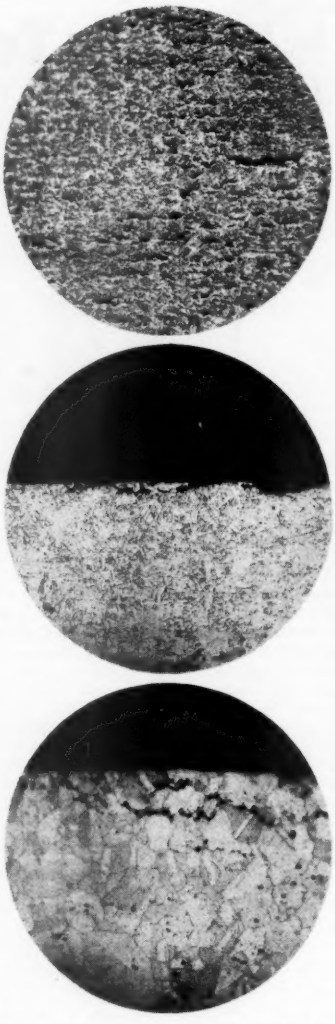

Fig. 4. Photomicrographs illustrating hydrogen embrittlement of electrolytic tough-pitch copper, commonly known as gassing. Upper view is of such a surface at about 10X. Center, a lengthwise section showing gassing on surface (about 30X). Below, a 125X detail from the center view.

113 New American Standards Added Last Year

The American Standards Association approved 113 American Standards in 1951, bringing the total of new and revised American Standards to 1181, Vice-Admiral George F. Hussey, Jr., has announced in a managing director's report on 1951 activities.

Membership of the American Standards Association, he said, now comprises 2246 companies and 109 trade associations, technical societies, consumer organizations, manufacturers' institutes and professional groups. This represents a net increase of 84 new company members and 12 organization members over 1951.

While most of the 113 new American Standards are in technical fields, Admiral Hussey said, many are of general consumer and public interest.

He further stated that 369 projects are now being developed under ASA procedures by sectional subcommittees. Among these are standards on rayon fabrics, model laws and ordnances, and office equipment.

In addition, the American Standards Association is participating in 23 projects within the 33-nation International Organization for Standardization.

New Standard on Surface Roughness

A guide to designers, inspectors and specification writers in designating the type of surface desired on industrial products, more particularly those with machined surfaces, has just been approved by the American Standards Assocation. This document is the American Standard for Physical Specimens of Surface Roughness and Lay, B-46.2-1952.

Two types of physical specimens are described in the standard. One type is for general purpose specimen blocks—blocks which represent machined flat surfaces as actually produced in the shop. The other type of block is used for precision reference work such as checking the calibration of surface roughness measuring instruments and is not intended to represent surfaces as produced in the shop by actual machining operations.

For general purpose blocks the standard contains a table listing, for various types of finishes, a

(Continued on page 117)

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Copper Alloys, from page 112

nickel alloys presenting less difficulty than the lower bearing nickel-bearing alloys. This is due to the high percentages of zinc within the composition; its reactance being similar to that of the brass compositions previously discussed. Dehydrated burnt ammonia provides an excellent atmosphere but it is quite costly.

In one installation the utilization of a protective atmosphere made from the dehydrated, sulfur-free products of a fuel gas [5a] has proved satisfactory in the annealing of the 18 percent nickel silver alloy at approximately one-tenth the cost of an ammonia atmosphere. The resultant protective atmosphere contained 9 percent carbon monoxide, 5 percent carbon dioxide, 0.2 percent methane, 10.9 percent hydrogen and 74.9 percent nitrogen. In addition, a low dew point was maintained in the cooling zone to prevent the formation of zinc oxide. Details as to the furnace used and the procedure can be obtained from the reference.

Both the silicon brass compositions and beryllium copper alloys are normally protected by a hydrogen atmosphere that is bone dry.

Where annealing is a common procedure, the difficulty known as "fire cracking" is well known; this type of failure being caused principally by an unequal relieval of stress when the item to be annealed is placed directly into a hot furnace. This phenomenon is more common on spun articles where an unequal distribution of stress is present. It may also occur on drawn shells such as is illustrated in Figure 5.

The elimination of fire cracking can be accomplished by the utilization of a preheat prior to annealing; the time and temperature varying with the specific alloy. Usually the temperature range will be from 350 to 600 deg. Fahr. and the time period from one to three hours; this latter factor depending upon the gage of material to be annealed, the type of alloy, the furnace load, and the specific form at the time of anneal. After the pre-heat, the alloy can then be placed directly into the furnace.

In both the yellow brass and the 60/40 (copper 60 percent, zinc 40 percent) compositions, hot breaks may be of frequent occurrence; the brittle temperature range being from 500 to 750 deg. Fahr. From the practical standpoint, there are several operations in which brittleness may cause trouble, thus removal and rough handling of unit parts from the annealing furnace while they are in the brittle range is a frequent cause of this type difficulty. An obvious solution would be either air or water cooling to room temperature before handling. This type of breakage can also occur in machining, rolling or beading and in buffing, and will require precautions such as proper cooling so that this brittle range is not encountered.

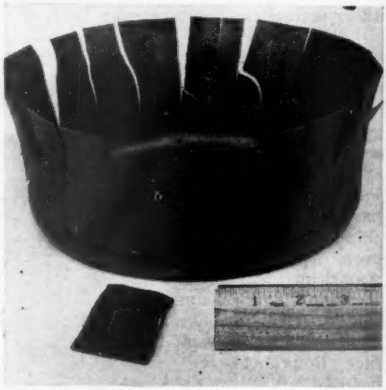

Fig. 5. Fire cracking of an 18 per cent nickel silver drawn shell.

Where a pickling operation is required to remove those oxides resulting from an anneal, the inorganic acids such as sulfuric and hydrochloric acids are commonly employed. This pickling operation usually produces a clean, lusterless surface and differs from "bright dipping" by surface appearance; the latter treatment producing a bright lustrous surface and is always preceded by the pickling operation. The various solutions commonly employed for pickling are listed, thus [7]:

Solution A

Sulfuric Acid	¼ to 1 gallon
Water	4 gallons
Operating Temperature	100 to 160 deg. Fahr.

(Continued on page 116)

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. . . Copper Alloys, from page 114

Solution B

Sulfuric Acid	½ gallon
Water	4½ gallons
Sodium bichromate	2 to 5 oz. per gallon
Operating Temperature	80 to 100 deg. Fahr.

Solution C

Sulfuric Acid	2 gallons
Nitric Acid	1 gallon
Water	1 quart
Hydrochloric Acid	1 oz. per 5 gallons
Operating Temperature	room

Solution A is more frequently used in the removal of scale deposits from copper and copper alloys including the tin bronzes, phosphor bronzes, manganese bronzes, naval brass and the aluminum brasses; the heavier the scale deposit, the higher is the concentration of the pickling solution and the operating temperature of the bath. Too high a temperature of a pickle bath will cause objectionable fuming and will increase the corrosion rate on equipment.

Solution B is used as a second operational step on brass compositions that still have a reddish cuprous oxide stain on the surface. Care should be taken in using solution B since either a too concentrated solution or a period of immersion greater than required will cause both etching and possibly pitting. These two factors can be best determined by trial. Ferric sulfate can be used in place of sodium dischromate, and for certain purposes it is preferred, particularly where attack on base metal is to be kept to a minimum.

Where it is desirable to obtain a glossy finish, Solution C is used. This, however, will follow the standard sulfuric acid pickle (solution A). The work is thoroughly rinsed and usually immersed in a 2 to 4 oz. per gallon solution of sodium cyanide to remove any acid stains. This is followed by suitable rinses.

In some instances, it is customary to add wood soot to the bright dip to insure uniformity of brightness on the surface of the dipped articles. The soot is stirred into the solution and the excess skimmed off; this procedure is said to overcome the effect of too much hydrochloric acid which results in irregular brightness.

A matte surface can be obtained after the bright dip operation by using a solution containing 65 percent by volume of nitric acid and one pound per gallon of commercial zinc sulfate. This dip is used at 180 deg. Fahr.; the parts being dipped, and then rinsed and dried in the usual manner.

It is advisable to anneal the aluminum bronzes in a controlled atmosphere due to difficulty in the removal of scale deposits. These alloys having 7 percent aluminum or less can be pickled in solution A; and the resultant finish is clean but dull in appearance. A modification of solution B can also be used. Bright finishes can be obtained only through mechanical cleaning, and alloys within this classification having more than 7 percent aluminum must have a mechanical action to remove the scale deposits.

Due to the refractory silicon oxide phase in the scale formation on the silicon bronzes, final pickling procedures demand the inclusion of hydrofluoric acid in order to obtain a bright clean surface. Initial pickling in solution A may be done to dissolve the oxides of copper; the final pickling solution should contain from 5 to 10 percent by volume of sulfuric acid, 10 to 20 percent by volume of nitric acid, 3 to 5 percent by volume of hydrofluoric acid and the balance water.

The solutions used for the pickling of the brass compositions can also be employed in the pickling of the nickel-silvers. The cupro-nickels can also be pickled in solution B and bright dipped in solution C. Pickling of the cupro-nickels can also be done in a solution containing up to 25 percent ferric sulfate and from 5 to 10 percent sulfuric acid which is operated at a temperature up to 150 deg. Fahr.

In the removal of scale in beryllium copper, solution A can be used, and the red staining that results can be easily removed by immersion in solution B.

Solution Treatment and Precipitation Hardening

The hardening and strengthening of a number of copper base alloys by thermal treatment is performed by a series of operations involving the controlled heating

(Continued on page 118)

. . . New Standards, from page 113

range of roughness heights in microinches, lay, and roughness width in inches. Six classes of surfaces are included: honed, lapped or polished; ground with periphery of wheel; ground with flat side of wheel; shaped or turned; side-milled, end-milled, or profiled; and milled with periphery of cutter. Altogether, nine roughness height values are given ranging from 2 to 500 microinches. For each range of roughness height values, a tolerance is given. For example, for shaped or turned surfaces with roughness heights ranging from 32 to 500 microinches, the tolerance is plus 15 and minus 20 per cent.

The specifications for precision reference specimens refer to surface contour, material, accuracy, uniformity and rating. The standard requires that roughness values of these specimens shall not vary from their designated values by more than plus or minus one microinch or plus or minus three per cent, whichever is the larger. For any given specimen of this type, the standard deviation of the peak heights shall not exceed five per cent of the nominal value of the height. This standard is a companion document to the American Standard Surface Roughness, Waviness, and Lay, B46.1-1947.

Copies of the American Standard for Physical Specimens of Surface Roughness and Lay, B46.2-1952, will be available from the American Standards Association, 70 East 45th Street, New York 17, N. Y., or from the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.

H. B. Smith Heads NAM Patents Committee

Harold Byron Smith, president, Illinois Tool Works Shakeproof Inc., Chicago has been appointed chairman of the Patents Committee of the National Association of Manufacturers, according to an announcement by NAM president William J. Grede.

The committee, composed of some 150 industry executives, is concerned with strengthening America's patent system. Major tasks this year will be the study of proposals for a revision of the patent laws, the promotion of public understanding of the patent system and study of government procurement regulations as they affect patents.

Mr. Smith is a director of the NAM, the Illinois Manufacturers Association, and Chicago Association of Commerce and industry.

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Copper Alloys, from page 116
and cooling of the material in the solid state. The purpose of the operations performed is to control the size and distribution of a precipitate formed by those soluble elements which have been intentionally added to the alloy. The term "solid solution" refers to the solubility of one metal in another; this phenomenon occurring very readily in a number of copper and aluminum base alloys.

The simplest explanation of this reaction can be made by the following analogy, thus: in the addition of salt to water, a definite amount of the additive, depending upon the temperature of the water, will go into solution. In raising the temperature of the water, a proportionally larger amount of salt can be dissolved; and conversely, the lowering of the water temperature will cause that salt which is in solution to precipitate or be thrown out of solution in the form of crystals. The size of the precipitated salt crystals can be increased by controlling the temperature of the solution.

Basically, the same phenomenon is realized in the copper base alloys such as beryllium copper where the additive element, beryllium, acts similarly to salt in a dissolving medium which in this instance is copper. The thermal treatment used to put this soluble constituent into solution and to prevent or retard its immediate precipitation is known as "solution heat treatment". It consists of placing the soluble element into solition by raising the temperature, pre-determined by the specific alloy, and after a suitable soaking period it is rapidly quenched which prevents, to a varying extent, re-precipitation.

The commercial strength of a heat treatable alloy is not obtained by the above treatment alone, but by a combination of a "solution heat treatment" followed by a subsequent precipitation or "aging treatment"; these two terms being used synonymously. This second treatment, which occurs at a lower temperature, will cause re-precipitation of the unstable phase and results in an increase in the mechanical properties of the alloy.

This "aging" treatment may follow immediately the solution treatment with no intermediate working being performed on the alloy. The alloy may be subjected to some cold working between the two treatments or, in some instances, cold work may be performed after the combined two heat treatments. The most effective sequence of operations where cold working would be involved would depend upon both the alloy and the specific properties that are desired.

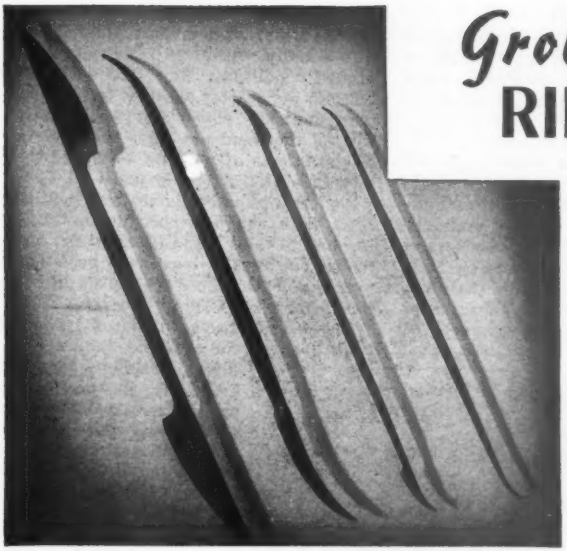
Solution heat treatment differs from an annealing treatment such as previously discussed. The processes of recovery, recrystallization and grain growth are similar in both treatments. In an annealing procedure, however, the temperature of treatment allows the precipitate of soluble constituents to coalesce or to grow into coarse particles so that they have less effect in restricting deformation. In solution heat treating, the soluble constituents at the temperature of highest solubility of the specific alloy will actually dissolve in the parent metal. A number of the copper base alloys respond to the treatment as stated above; the most commonly used alloys are listed herewith.

Alloy	Chemical Composition, Percent					
	Copper	Beryllium	Nickel	Cobalt	Chromium	Phosphorous
Beryllium Copper	97.65	2.00	0.35*	0.35*		
Nickel Beryllium Copper	98.10	0.40	1.50			
Cobalt Beryllium Copper	97.00	0.40		2.60		
Chromium Copper	99.40				0.60	
Copper Nickel Phosphorous	98.50		1.25			0.25

*Either one or the other

Since beryllium copper has gained the widest industrial acceptance and application of the alloys listed, it may be better to limit the discussion to this specific alloy composition. The beryllium copper alloy is characterized by good corrosion resistance, good electrical conductivity, both high tensile and fatigue strengths, high hardness and low stress-strain hysteresis. The

(Continued on page 148)



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TOMORROW I'LL YOU BE SATISFIED WITH THE JOB YOU DID TODAY?

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Hi-Jet, from page 169

duration of operation in minutes before the tools failed. The test was set up so that each tool failed in 3 to 6 min. when cutting without lubricant in an effort to shorten the duration of the Hi-Jet test to a couple of hours instead of days.

The majority of tests were made on SAE 1020, SAE 3140, and SAE 3150 steels with high-speed tool steels. However, additional tests have been run on stainless steel with high-speed tool steels and another series of tests was made on SAE 3150 with carbide tools. One of the most interesting characteristics of these tests was the consistency of the results produced by Hi-Jet. Tool life under test conditions never varied more than 25% and was usually within 10% for a given set of test conditions. This is a decided contrast to the scatter obtained with the older test methods which vary as much as several thousand per cent, due principally to the effects of built-up edge and microstructure of test specimens.

At Thompson Products, Inc., additional tests were run on a production basis on Inconel M and AISI 8742 with carbide tools. The results here have been just as remarkable as those at Gulf's Research Laboratory.

On aircraft valves made of Inconel M, for example, the number of pieces machined per tool grind by the old method was extremely low because of the tough gummy nature of this nickel-chromium alloy. When Hi-Jet and Gulf Hi-Jet Oil were applied to the job, the number of pieces machined before tool regrinding was necessary was increased a minimum of three times.

In the second group of tests, on a 3 in. diameter shaft of AISI 8742 steel, a 3 to 1 improvement in tool life was produced with Hi-Jet.

The new system was in the experimental stage for nearly a year, and over 600 tests have been made on a variety of metals ranging from SAE 1020 to titanium. All the tests showed a remarkable improvement in cutting tool life with the increase on high speed tools from 6 to 12 times and on carbide tools from 3 to 5 times.

All comparisons have been made on the basis of using the best conventional oil recommended for the type of metal in connection with the overhead flood method and with Hi-Jet and

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Gulf Hi-Jet Oil.

At first, Hi-Jet will find the widest application on turning operations simply because it can be more easily applied to lathe tools. However, with suitable nozzle designs and attaching fixtures, Hi-Jet is practical for many other types of machining operations.

Good results can be produced on most types of lathe and boring mill work, but the most remarkable savings will be made on high-production jobs, where tool life is abnormally short. Hi-Jet is extremely practical for jobs where setup time is high in relation to operating time on the machine or where the number of tool changes is excessive. It is also ideal for low-speed operations where large amounts of metal must be removed.

Hi-Jet equipment, as it is presently manufactured, will include all the parts necessary to mount it on most types of engine and turret lathes, with the exception of a single section of angle or channel. And several styles of nozzles provide for different sizes and shapes of tools.

Hi-Jet has only a few component parts, consisting of a motor-driven pump, filter, pressure-regulating valve, jet nozzle, nozzle holder, and special low-pressure coolant spray. The suction side of the system is connected to the existing coolant system and the discharge end is connected by flexible hose to the jet nozzle, which is held in the nozzle holder and attached by a suitable fixture to the cross slide or toolholder of the lathe.

The jet nozzle must be mounted in such a way as to avoid chip interference. The stream of oil should be carefully aimed and firmly held so that it is always in contact with the cutting edge of the tool. This is the most important consideration in mounting. Misdirection will mean loss of advantages inherent in the new method.

Hi-Jet will be manufactured by Thompson Products, Inc., of Cleveland, Ohio under licenses from Gulf Research & Development Co. It was invented by Mr. R. J. S. Pigott, director of engineering research of the Gulf Research & Development Company. Current tooling schedules indicate delivery of the first production units on or about July 1, 1952.

In addition to the immediate advantages, Hi-Jet and Gulf Hi-Jet Oil offer other indirect advantages.

As a result of increased tool life, setup and tool grinding time on many jobs can

(Continued on page 149)

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Keeping Operators Safe in Forging Operations

There are certainly many aspects and approaches to the problem of "Keeping Operators Safe in Forging Operations." One of the instructions to keeping operators safe would be eliminating undue risk by requiring a physical examination. This procedure will eliminate those not able to perform, to a great extent, our rather heavy type of work. Surely if we are going to have a good record we will want to start with our employees physically fit.

If we are going to keep operators safe, one of the positive approaches would be to let them know what we expect of them. It doesn't take too much time, before an employee goes to work, to go over the program of accident prevention in your plant with him. This gives him a different perspective entirely than when we allow that same person to find out the hard way or through experience of getting hurt. We assume too often that they know or should know these things. This can be done by the personnel department or by the safety director.

Accidents don't just happen; they result from unsafe mechanical or physical conditions, an unsafe act of the employee or a combination of both of these factors.

There are several safety features about hammer operations which can be used. These reduce risks and therefore are advisable. To enumerate a few: we use wire cable to keep the segment arm from hitting the operator in case of breakage. The wire mesh guard over the operator's head is kept from breaking off by wire cable attached to outer corners. Head bolts and front releasing rod have wire cable attached to them, then to a stationary part of the hammer. The large pin in the eye on the front or operator's side of the housing has wire cable attached to that.

All these safeguards prevent the operator from getting hurt in case any part should break. A hammer board guard box also prevents hammer boards from injuring the operator or others nearby if they break while the hammer is in operation. Scale shields are attached to the base of the hammer and prevent the scale from blowing into the eyes of those passing by the forging operations or even the operator himself.

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by **F. W. Fiske,** Safety Director
THE BREWER-TITCHENER CORPORATION, Cortland, N. Y.

The Drop Forging Association Safety Committee has spent much time and effort to ascertain if there was anywhere a porable pneumatic key driver. Today one of the most used devices for driving keys in or out is the battering ram. There is always a risk of mushroomed pieces breaking off the ram or the key.

Now one of the drop forge plants has reported a pneumatic air operated portable key driver. They have two sizes and report success with them. Both are transported by industrial lift trucks. They report this operation only requires fifteen minutes to perform. In addition the operator is protected from the key or drift fragments.

We at The Brewer-Titchener Corporation have installed on all our board drop hammers the air trips. This means we have taken off the wooden foot treadle and subsituted the air trip.

★ ★ ★

Mr. Fiske's article originated as an address before the National Safety Council's 1951 Congress. We gratefully acknowledge the Council's permission to present it here. Ed.

★ ★ ★

This trip is guarded as a part of the unit and therefore a definite safety feature as it is not possible to trip the hammer accidently by dropping anything on this trip. This can happen with the usual wooden treadles; the principle of the operation being that the air in the cylinder raises the lift rod which controls the rolls and then the rod drops of its own weight.

Another feature in keeping operators safe in the forging operations in the use of the air trip is the elimination of much of the fatigue of the operator. With the wooden treadle, not only is it not guarded but you have to lift your foot up in order to trip the hammer. With air trips you keep your heel on the floor and your foot on the small pad of the air trip. In other words you don't take your foot off the platform you are standing on. There is some maintenance in connection with their operation but certainly not excessive.

(Continued on page 128)

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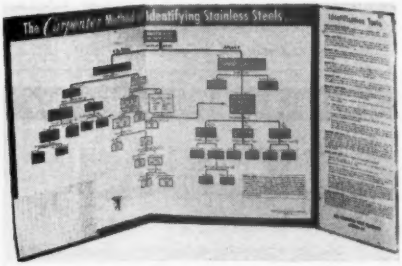
Carpenter's Four-Color Segregation Chart, designed to help users of stainless steels quickly identify various stainless types, has been revised. It is also useful in separating stainless



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A New Maintenance Manual on Stud Welding is being offered by KSM Products, Inc. "Maintaining Your Stud Welder," a companion piece to KSM's Operating Manual, consists of 12 pages containing eight drawings and charts and 12 photos. Accompanying text helps to explain the various aspects of maintenance against a background of specific components and problems. The manual is divided into three basic sections: general information, maintenance, and accessories. Write to Stud Welding Div., KSM PRODUCTS, INC., Dpt. T&P, Merchantville, N. J.
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"Principles of Abrasive Cutting" is an informative, 36-page Campbell booklet covering the basic principles of abrasive cutting, its

methods and applications. Address CAMPBELL MACHINE DIV., American Chain & Cable Co. Inc., Dept. T&P, Bridgeport 2, Conn., and ask for a copy of Booklet DH-301.
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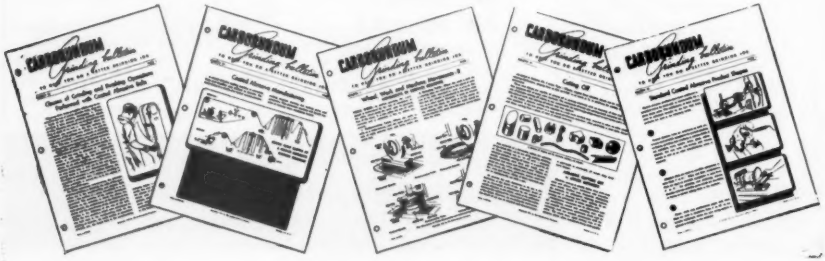

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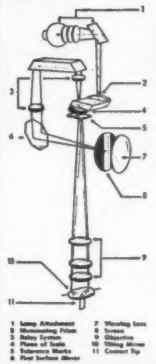

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This LEITZ ORTHOMETER speeds up inspection, allows more than one person to view scale simultaneously. The only moving parts are the contact tip and mirror.

One graduation represents 50 millionths. Guaranteed accuracy over full range of 200 graduations (.010") is .00001".

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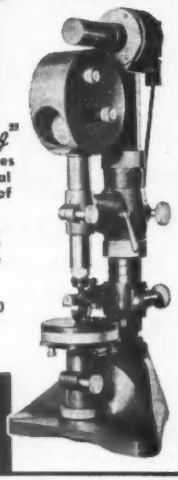

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41 YEARS EXPERIENCE

WHITNEY-JENSEN

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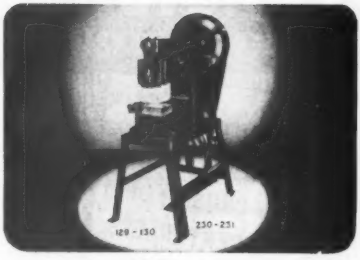
Deep Throat
Power Punch Presses



These efficient presses feature: high speed, deep throats, all steel welded frames, inexpensive auxiliary attachments, various punches and dies from stock. They have a 5-ton safety factor.

Throat Depths—12" and 18"
Capacity—10 tons

WHITNEY METAL TOOL COMPANY

724 FORBES STREET • ROCKFORD, ILLINOIS

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

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should use Chicago "Safety Plus Screws in Standard Listed Sizes.

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Chicago "Safety Plus" Screws are designed to give you a tighter, lower cost fastening for any heavy duty purpose. To speed delivery time, call the INDUSTRIAL SUPPLY DISTRIBUTOR nearest you today. Ask for Chicago and get "Safety Plus."

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THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

Two Aluminum Solders that are especially proficient in joining copper to aluminum or other metals and ten rods and electrodes for work on copper and copper-bearing alloys with torch, soldering iron and arc, are featured in an illustrated All-State folder. The folder is titled "How to Use and Apply All-State Alloys and Fluxes for Welding, Brazing and Soldering Copper and Copper-Bearing Alloys." There are complete instructions for use, techniques of application and description of the properties of the alloys. Write to ALL-STATE WELDING ALLOYS CO., INC., 273 Ferris Ave., White Plains, N. Y.
Circle Inform-A-Gram No. C5.

"Proper Valve Lubrication—A Prerequisite to Good Control is a new Honeywell article reprint that discusses the importance of proper valve lubrication in keeping valves operating at peak efficiency. Also covered are the function, proper selection, methods of application and the various types of lubricants in general use. Featured is a Honeywell Valve Lubricant Selection Chart. Address all requests for this reprint to MINNEAPOLIS-HONEYWELL REGULATOR CO., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44, Pa.
Circle Inform-A-Gram No. C6.

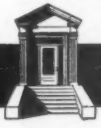
A Colorful Wall Chart listing all of the Ampco bronze weldrod and wire products available by trade name, together with AWS-ASTM designation, has just been released. In addition, and opposite the trade names, are descriptive information, typical applications, mechanical properties, deposit chemical composition, recommended current and polarity, N.E.M.A. color markings and diameter sizes. Also included is a copy of the "Bronze Electrodes Selection and Preheat Chart." Send requests to AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 46, Wis.
Circle Inform-A-Gram No. C7.

"Heat Treatment of Aircraft Steel" is a leaflet showing how hardness required to meet U. S. Government Specification MIL-H-6875 may be safely effected through the use of high speed quenching oils. The maximum hardness and strength of aircraft steels must be developed in heat treating. Hardness must extend to the core of the maximum sectional thickness, with no allowance being made for steels which may be on the low side of the hardenability range. Write to E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Circle Inform-A-Gram No. C8.

"The Engineers' Illustrated Thesaurus," by Herbert Herkimer, is a new book containing over 8000 illustrations of machine elements and assembled machinery for the engineer, designer, draftsman and manufacturer to select the machine parts or equipment most suitable for his special purpose. It will also serve as a guide for students and beginners. Every conceivable type of machine element is reproduced and identified. Price is $6.00 a copy. Write the publisher, CHEMICAL PUBLISHING CO., INC., 212 Fifth Ave., New York 10, N. Y.

ANOTHER GRINDING ROOM PROBLEM SOLVED!

The small, precision-built machine you see above is the Radi-Form, a grinder attachment, that does almost everything but talk. The Radi-Form can move the work in a predetermined arc of any desired radius, from 1/16" to 2" concave, from .00 to 2" convex, which means that radii can now be generated even on carbide tipped cutting tools in a matter of minutes, to within .0005 accuracy on a standard, unformed, cupped diamond wheel. You save headaches, time, and gain increased production. Write for literature and prices that will surprise you.



W. F. MEYERS CO., INC., BEDFORD, INDIANA

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Operator Safety, from page 123

To keep operators safe in forging operations there are many items which should be used. Hard hats are quite commonly used in the forge industry to protect the head from falling objects. In a few cases, our Safety Committee of the Drop Forging Association, in making inspections of member plants, have been asked to wear these hats. If your hammers are not equipped with wire screen sections over the heads of the operators, certainly hard hats are recommended.

To give us a more accurate idea of where risks are in drop forge operations, the Drop Forging Association's anlysis of department lost time accidents shows hammermen and upsetters with a frequency rate 66.4, raw material handlers as 36.9 and in third place, heaters, helpers and hot trim at 34.8.

In many forging operations, especially in the forging of aluminum, leather aprons give needed protection to the operator. Occasionally flashings fly from the die and this leather apron prevents injuries to the abdomen.

Many types of gloves are worn to protect the hands of both hammermen and helpers and other groups working in the forge industry. According to the annual report of the Drop Forging Association, cuts, bruises and contusions rank first as injuries to hammermen, upsetters, heater, helpers and hot trim. Raw material handling is likewise classified. This shows the need for hand protection. Many asbestos hand pads are used for further protection against the heat and ordinarily are furnished free to these men.

In the matter of gloves, there are many ways of handling this situation. I believe the most common one is where management provides the various types of gloves and has them available in the plant. Often they are sold below cost to the employees.

Safety shoes prevent many toe accidents, therefore some plants make it a must to wear them, others encourage it. Some plants subsidize part of the cost, others keep them in stock and charge the actual cost, still others and probably smaller plants issue an order to some local shoe store or send away for them and deduct the cost over several weeks. I am convinced of one thing in this field and that is that it is essential to get a good fit and the right type if you are going to have satisfied customers. The Drop Forging frequency rate for 1950

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Will Do Anything That Machines Costing 2 or 3 Times More Will Do

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ABERDEEN S D

on toe accidents for hammermen and upsetters was 4, in raw material handling 3.8.

Another important factor in keeping operators safe in forging operations is eye protection. The drop forging industry department frequency rate of lost time accidents for 1950 shows 6.4 for hammermen and upsetters. This brings out the need for eye protection. The next highest frequency rate in any other department is the die room and machine shop with 2.

Harry Gilbert, formerly of the Pullman Company, was probably the outstanding exponent of the need for eye protection. He often cited the fact that even office workers lost vision due to pencil points breaking and striking them in the eye.

This may be somewhat exceptional but surely drop forge employees are faced with some real risk in performing their duties; scale flying from dies, steel mushrooming from sets, battering rams and mauls. Small pieces of steel have been known to fly from the drop die itself due to crystalization. In many plants dust and dirt are blown into the eyes of hammermen and helpers from individual cooling fans, placed nearby to reduce the heat from the furnace and the heated bar being handled.

These are some of the risks that men in the forge department have to contend with. This problem is generally handled in preventing eye injuries by what is termed 100 per cent use of goggles or shields. In other words many plants have handled the prevention of eye accidents by the fact that everyone, even visitors, wear eye protection while in the forge plant.

Probably the most commonly used device is the goggle with safety lenses and side shields. We often hear the excuse that they fog up. You will find at this convention, exhibitors who will demonstrate to you how effectively this condition can be reduced. If this is one of your problems, I recommend you get in touch with them before you leave this convention. Dispensaries placed at convenient locations will not only take care of the fogging situation, but will provide material to keep lenses clean. These materials are necessary to a good efficient eye program.

There are other schools of thought that feel that this program should not be compulsory; that to make eye protection available and attempt to get employees to use it will accomplish results. In either program, I feel you need a further service.

We in our plants built a regular goggle

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Completely Flexible

AIR-MITE now supplies solid steel upright columns in any lengths required to give you these important flexibility features:

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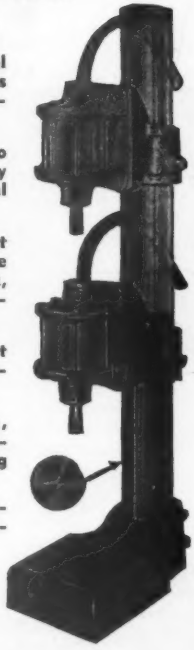
3 Rapid socket wrench adjustment cylinder bracket swivels for perfect alignment with work.

Presses are available in ¼, ½, ¾ and 1 ton capacities—for staking, riveting, marking, punching and similar operations.

Write for complete catalog of Air-Arbor Presses and single and double acting Air Cylinders.



AIR-MITE

4417-B West Carroll Ave.
Chicago 24, Ill.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

cart that has casters on it so it can be pushed around through the departments. This cart has compartments in it for various types and sizes of goggles and all the necessary repair parts and tools. One day a week a man who has been trained by a national optical company goes through the shop and fits, repairs and takes care of the requirements of our employees.

If some one has a gripe that the goggles hurt his nose or his ears, this man can eliminate his trouble and cause him to be a satisfied customer. This is vital to success. Furthermore, if he wears correction, we furnish him with a blank to take to his own oculist and the correction is noted, together with other necessary information and returned to our goggle attendant. He places the order through one of the nationally known optical companies and soon the employee has safety goggles with his own correction to wear.

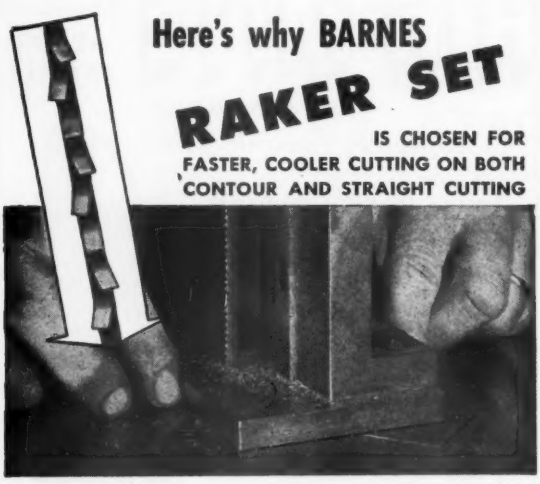
To show management's interest, the company pays one-half of the cost of the complete lenses and frames. This is only done where goggles are ordered with side shields and with the understanding they are to be left on. There is 60 per cent protection where goggles have no side shields and 98 per cent with.

Some years back before this program was instituted we had the tragic experience of someone occasionally losing an eye. Since this program has been in operation no employee has had loss of vision. For 1950 we had three lost time eye cases, none serious, and eight others with no lost time involved. In 1943, before the present program was put into effect, we had loss of vision in two eyes and thirty-two other doctor's orders issued for a total of thirty-five cases in our plant. We have a long way to go but we have made some progress on this basis.

The Safety Committee of the Drop Forging Association recommends, however, the program of 100 per cent participation in wearing goggles for the most effective results. It is surprising how many forge plants today operate on this plan.

Still another phase in getting safety down to the man on the job is as follows: we find that asking the hammer operator to be responsible for their crew under them, helps to some extent. Something like the buddy system with Scouts while in the water.

We think the policy of giving out a "Safe Worker" to all our employees helps to get safety down to the man on the job. The comic approach is still effective.



Raker set, because of its design, assures a fast cutting rate. It retains the saw kerf width for radius cutting. It combines strength with more efficient chip clearance where most cutting is on larger solids.

See your Barnes Distributor for dependable saw blades and dependable technical advice.

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W. O. BARNES CO., INC.
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We like the idea of putting up for one week only, some appropriate poster which we get through our membership in the National Safety Council. We select these to fit our needs. If you have someone in your employ who has some talent in this connection, you should by all means make use of them.

It has been our experience also, that, if we have a higher frequency of injuries than we should have in a department, we close down the operations, say ten or fifteen minutes before noon, and get the employees together in a group. A platform is placed right in the forge shop and I speak from this vantage point. Oftentimes this platform is what the men use to replace hammer boards. Very often you will find the average employee doesn't know what the actual situation is. You can put notices and reports up; surely some are interested and read them, but others don't. Through this idea you get across your message and it is very much more personal. I have found that where you let employees know how the situation stands, a majority of the time they will do something about it.

Finally, one of our most effective methods of getting all-out participation of all our employees in accident prevention is through "No Accident" campaigns. We run two of these a year, one lasts thirteen weeks and the other eight weeks. The longer one is where we sign up in cooperation with the New York State Associated Industries. Ordinarily it starts early in September and finishes early in December.

We receive weekly reports of just where we stand. In addition I get out a weekly report covering the standings of each one of our divisions. These have been entered separately. I also briefly cover any doctor's orders issued or any lost time cases. Most employees are interested to know how their own division is making out and also how much competition there is.

When the state-wide contest is concluded, award dinners are held by the Chamber of Commerce of certain of the centrally located cities. Top notch speakers and entertainment are provided. Awards of trophies, plaques and merit ratings are made. We see to it that a good group is present at this dinner from each division regardless of whether they are to receive an award or not.

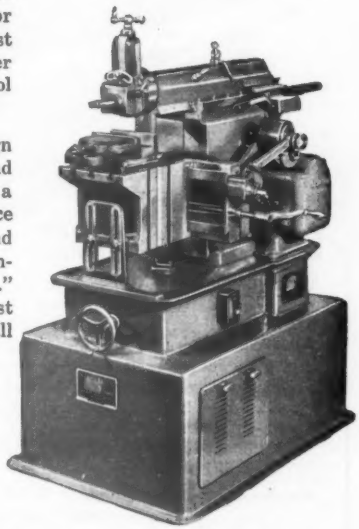
The other campaign we run is our own inter-division contest. This runs April and

(Continued on page 155)

Big Shaper Performance Small Shaper Price

The SHELDON 12" Back-Geared Shaper is neither too big, nor too small. It is just right for most shaper work in most tool rooms and shops.

In weight, design features, capacity and performance, it is a "big shaper." In price operating cost and floor space, it resembles a "small shaper." It is the logical 1st shaper for the small shop and a cost-cutting tool in multiple installations in large plants.



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CHICAGO

SHELDON MACHINE CO., Inc., 4235 N. Knox Ave., Chicago 41, Ill.

New G-E Program Will Train Men for Manufacturing

A new major training program designed to prepare young men for careers in manufacturing in the General Electric Company has been announced by Nicholas M. DuChemin, G-E Vice-Pres.-Mfg.

The three-year program will train men for supervisory, administrative and technical positions, and will provide a sound understanding of basic manufacturing principles along with knowledge of all phases of shop operation and related functions, the G-E official said.

The new program is the fifth major company-wide training program that G-E has founded. The company conducts a 12-15 month Test Course, under which college engineering graduates test the company's various electrical products during rotating three-month assignments; a Business Training Course, under which business administration and liberal arts graduates study accounting and allied business subjects as a background for accounting and financial management positions; a Physics Program of rotating assignments for college physics majors; and a Chemical and Metallurgical Program which trains chemical and metallurgy graduates in basic research, the engineering, manufacture and sales of chemicals and metal alloys, and the development and application of materials and treating processes for the company's fabricated products.

Mr. DuChemin said that General Electric's decision was based upon tremendous demands for trained manufacturing personnel caused by current high production rates, the highest in the history of the company, and even higher anticipated production in the years ahead.

"The time is past when we can hope to develop sufficent numbers of competent manufacturing supervisors and specialists without providing a broad foundation for their development through a planned program of training. The current manufacturing demands must be met by a specialized program which will prepare men for careers in manufacturing," Mr. DuChemin said.

He stated that the new program would be a permanent addition to General Electric's training system, and that it would gradually integrate several local manufacturing training programs sponsored by individual units of the company.

Mr. DuChemin explained that trainees for the pro-

YESTERDAY'S PIONEER . . . TODAY'S LEADER

TAPERED
END MILLS CONSTANT SPIRAL

(Die Sinking Cutters)

● The extensive line of the well known Weldon End Mills includes Tapered End Mills, Constant Spiral. Also known as Die Sinking Cutters these end mills, filling a definite need, come in a wide range of sizes, giving a choice of many lengths and diameters. Weldon Tapered End Mills as standard stock items are all 3-flute, and offer a choice of ½°, 1°, 2°, 3°, 5° and 7° angles. They represent the same high quality for which all Weldon End Mills are famous.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL CO. Cleveland 4, Ohio
3000 WOODHILL ROAD

gram would be selected from qualified college graduates in fields of engineering, business administration and the sciences, and also from within the company organization, including graduates of the G-E Apprentice Training Course.

Ages of the trainees will range between 22 and 28 with major emphasis of selection upon educational background, character, intelligence and potential for development toward positions of responsibility in the manufacturing organization.

Mr. DuChemin said trainees would receive a series of rotating assignments, classified as shop, functional and general.

Shop work, he said, will permit trainees to acquire fundamental experience in the use of tools, and the operation of machines on a production basis.

Functional assignments will include training in manufacturing methods and planning, production and purchasing, cost and expense control, and wage rate and time standards.

The general group of assignments will place the trainee in personnel and labor relations activities, manufacturing administration, marketing and engineering.

Classroom sessions will be held 36 weeks a year with two, two-hour sessions weekly. These sessions will supplement job experience being gained by the trainees during the three-year program.

Headquarters for the program will be in Schenectady with a number of training centers located at key plants throughout the country.

RONALD J. AHERN, president of The Billings & Spencer Co., has been appointed to the Drop Forging Industry Advisory Committee of NPA.

International Foundry Show at Atlantic City in May

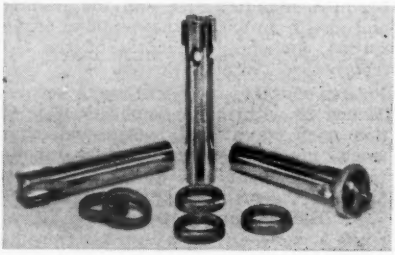
"**Every** Foundry in '52" has been adopted as the slogan of this year's International Foundry Congress and Show which takes place on May 1 through 7. The show is sponsored by the American Foundrymen's Society and will be held in Atlantic City, New Jersey.

The slogan was chosen to stress the importance of aggressive foundry participation in this year of rearmament for defense. In terms of new developments and new equipment on display, and in numbers of operating exhibits, this foundry show is expected to rank among the best ever held since the original foundry exhibit at Cleveland in 1906. With the emphasis on **every** foundry's interest, the technical program is pointed toward practical operations and methods.

Now!
A DRILL PRESS VISE THAT SAVES RESETTING
BUILT-IN PARALLELS AUTOMATICALLY SQUARE WORK
JAWS ARE PRECISION GROUND AT RIGHT ANGLES TO PARALLELS
DRILL FROM THE TOP
DRILL FROM EITHER SIDE
DRILL ROUND STOCK
Turn out more drill press work easily . . . drill from three directions accurately—with just a single setting of stock. The Heinrich Handy Drill Press Vise automatically squares work . . . built in V-groove permits precision side and end drilling of round stock. See your Distributor or write for further details.
HANDY DRILL PRESS VISE BY . . .
NATIONAL MACHINE TOOL CO.
Dept. 132-D • RACINE, WISCONSIN

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Carbide-Tipped Tap Life 7 Times That of HSS



Pratt & Whitney carbide-tipped taps outlived high speed steel taps more than seven to one on a recent production run of diecast parts. The P&W carbide taps had an average life of 30 hours as compared to the high speed steel taps' four-hour life. In many cases the carbide taps could stand three sharpenings after the original cutting edge had failed. Not only did they pay for themselves immediately but the additional usage brought tool costs 'way down on the job.

Although the thread finish obtained with the high speed steel taps was very smooth when the taps were sharp, it deteriorated rapidly as the taps began to wear. The carbide taps, on the other hand, produced an average thread finish throughout their life.

Complete details and descriptive literature on P&W carbide-tipped taps can be obtained by writing to PRATT & WHITNEY, Div-Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn., or by Inform-A-Gram No. D2.

★ ★ ★

Standardization Meeting

Session dates for the meeting of the Screw Threads Committee of the International Organization for Standardization have now been set for June 11 through 14 at Columbia University in New York. These sessions will be held in conjunction with the triennial meeting of the ISO at Columbia, June 9 through 21. The announcement was made by the American Standards Association.

Twenty-one nations—including the United States—actively participate in the international program of thread unification. American industry is the largest producer of bolts, nuts and screws, as well as the countless other articles in which threads are used for assembly of their component parts or for other purposes.

Get Hep
to
FRICTION
SAWING
with
Tannewitz HIGH SPEED
BAND SAWS
IT'S THE FASTEST, MOST ECONOMICAL MEANS OF CUTTING METAL AND MANY OTHER MATERIALS
There's a revelation in store for you if you have never tried friction sawing with these machines. Flat sheets of either soft or hardened steels, non-ferrous materials can be sawn in a fraction of the time required by other methods. Cutting armor plate and other materials is not impractical, and for cutting formed parts there's nothing that compares with it. Cuts are smooth and down-drag of saw is so minor that no rest of any kind is needed. Write for your free copy of "FRICTION SAWING", Now!
For trimming castings of all types of metals our variable speed band saws are real production expediters. Write for bulletin.
SAWING MACHINERY SPECIALISTS
THE TANNEWITZ WORKS
GRAND RAPIDS, MICH.

. . . Forging Dies, from page 102

in the same hammer and then is bent around a 1-13/16" radius at its center point to give the forging a V-shape, using a side arm die in a press.

It is then necessary to place the forging in a bulldozer, as shown in Figure 13, and there bring it to its final shape, Figure 14. Although the bulldozer completes a U-bend, the two bosses are brought almost together so that the forging is virtually a closed link, which it finally becomes when the ends of the two bosses are joined subsequently by arc welding.

After leaving the bulldozer, however, the forgings are clamped in the fixture, Figure 15, to prevent them from spreading while cooling takes place. It then remains only to put forgings through a Wheelabrator for scale removal to make them ready for welding. This large number of operations is needed to yield a sturdy forging of the shape specified, yet the production rate on this piece is 24.3 per hour (not including welding). Completed forgings weigh 55 lbs. each.

★ ★ ★

Norton Company has appointed Sheldon V. Coleman as sales engineer in the Norbide Division and Floors Division. Mr. Coleman was formerly a boron carbide engineer. He succeeds Henry O. Richter who retired after 38 years with the company.

Detroit Stamping Company. Appointment of George A. Bentley as sales manager in the Stamping Division has been announced. Since joining the company 13 years ago he has worked successively as Methods Engineer, Production Estimator, Sales Engineer and Assistant Sales Manager.

A Treatise on Milling and Milling Machines

A new book, thoroughly covering the theory and practice of metal cutting by the milling process, has been published by the Cincinnati Milling Machine Co.

The text and illustrations cover the functions and operations of a variety of milling machines and milling attachments: cutting tools and technical data on metal cutting; a wide range of practical applications of toolroom milling and die sinking; principles of fixture design; practical examples of modern production methods and the selection of milling machine equipment.

The book contains 896 pages, 200 formulae, 700 illustrations and is priced at $8.00 per copy, postpaid. Write the Technical and Service Publications Dept., of the Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

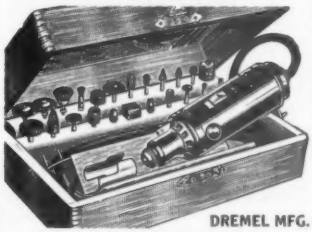
SPEEDS UP TOOL ROOM AND PRODUCTION LINE OPERATIONS

DREMEL *Electric* MOTO-TOOLS

MOTO-TOOL No. 2, with one emery wheel point.— $16.50

MOTO-TOOL KIT No. 2, with accessories, (high-speed steel cutters) and Model 2 Moto-Tool in natural finish hardwood case — $23.50

APPROX. 27,000 R.P.M.



Dremel Moto-Tools, widely used in industry for over 15 years, are World War II Veterans — served in defense plants and military maintenance bases everywhere. Hundreds of operations—polishing and grinding dies, burring parts, sharpening cutters, etc.—performed in seconds *without tearing down "setups"*. Moto-Tool is sturdily constructed for continuous duty. Weighs only 13 oz. —approx. 27,000 r.p.m.—dynamically balanced for vibrationless operation.

WRITE FOR INDUSTRIAL CATALOG

DREMEL MFG. CO. Dept. 522-D RACINE, WIS.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Ingersoll Inserted Blade Face Mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters and boring heads are among the cutting tools described in The Ingersoll Milling Machine Company's comprehensive Catalog 56.
Circle Inform-A-Gram No. B1.

Metal Baskets, dippers, strainers and containers for materials handling are described in an illustrated brochure from Hoffman Co. Standard and special baskets are shown, and a current price list enclosed. HOFFMAN CO., CO., 41-43 N. Penn St., York, Pa.
Circle Inform-A-Gram No. B2.

famco Model "612" METAL CUT-OFF BAND SAW Offers New Design Features

ANOTHER COST-CUTTING MACHINE

• Truly a finished machine tool, the Famco "612" Metal Cut-Off Band Saw cuts all shapes, all types of metals. It's ruggedly built of semi-steel castings and alloy steel. Cast aluminum guards provide extra safety. Capacities up to 6" round and 6" x 12" rectangular stock. Made in the typical Famco tradition of "the highest quality machine for the money."

A Few Famous Famco Features

Open construction for easy access; microset stock stop for quick setting, precision sawing; ⅝" x .032 blade; coolant system added in a jiffy; improved design means easier blade changes; Timken roller bearing equipped transmission; quick setting guide arms; blade guard telescopes automatically; 50, 100, 175 and 300 FPM cutting speeds; vise jaws adjust to 45° angle.

Write for Free Catalog

Complete information, including models, specifications and new design features, is available in a new illustrated catalog.

FAMCO MACHINE CO., 1344 18th St., Racine, Wis.

famco (COST CUTTING) machines

ARBOR PRESSES • DRILL PRESSES • METAL CUT-OFF SAWS
POWER PRESSES • FOOT PRESSES • SQUARING SHEARS

Danly Underdrive Presses are described in a new catalog, said to be the first produced dealing with this particular type of press. Principal feature of Danly Underdrive Presses is placement of the clutch, brake and other major drive components on a level below the actual working area. Maintenance and service are performed on a separate subfloor level and production operations are not interrupted. Completely illustrated, the new catalog contains detailed specification data and explanation of operating features. DANLY MACHINE SPECIALTIES, INC., 2100 S. Laramie Ave., Chicago 50, Ill.
Circle Inform-A-Gram No. B3.

Ampco Safety Tools are covered in a new, four-page booklet. This highly illustrated publication contains facts about the complete line, which includes wrenches, chisels, screwdrivers, hammers, pliers, etc. Materials of construction and usage together with a cataloging of sizes, weights and other data are included. Write AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 46, Wis., and ask for Bulletin ST-5.
Circle Inform-A-Gram No. B4.

The PAR-AC Electronic Production Gage is a shop instrument for high-precision, repetitive gaging of one or more dimensions. Detailed specifications, excellent illustrations and extensive descriptions of this gage and its features are given in a four-page brochure just published. Write to the manufacturer, GRAHAM-MINTEL INSTRUMENT CO., 735 Carnegie Ave., Cleveland 15, Ohio, and ask for Bulletin 103.
Circle Inform-A-Gram No. B5.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

Answers to 39 Production Problems commonly encountered in the manufacture of small parts, are found in "Air Power at Work", a new 16-page informative booklet that shows and describes actual application of various semi-automatic and fully automatic combinations of standard air-operated devices—workfeeders, presses, timers, valves, cylinders, fixtures, etc. MEAD SPECIALTIES CO., Dept. NB-32, 4114 N. Knox Ave., Chicago 41.
Circle Inform-A-Gram No. B6.

Faster, Cleaner Gouging and Chamfering, in preparation for brazing or welding, is offered by new "ChamferTrode", an electrode having a heavy coating which forms a cone at the striking end of the rod. The natural jet effect arc gives an intense, concentrated heat which swiftly removes unwanted metal, while adjacent metal remains relatively cool. Oxidation, slag, and warpage are absent or negligible. Booklet can be obtained from EUTECTIC WELDING ALLOYS CORP., Dept. P, 172nd St., at Northern Blvd., Flushing 58, N. Y.
Circle Inform-A-Gram No. B7.

Full Lathe Capacity on any turning operation is ensured with Kienzle speed and feed selector, a calculating and indicating device that can be easily installed on any standard lathe. Eliminates guesswork and saves time in establishing optimum combination of speed, feed, depth of cut, and tool material for any given work material. Descriptive folder available from importer. GUTHERY MACHINE TOOL CORP., 130 W. 42nd St., New York 18.
Circle Inform-A-Gram No. B8.

The Marvin Dividing Head is a small dividing head of extreme accuracy and an unusual range of divisions. Use collets, universal or independent chucks, or center. Price and range uses obtainable from Marvin Machine Products, Inc.
Circle Inform-A-Gram No. B9.

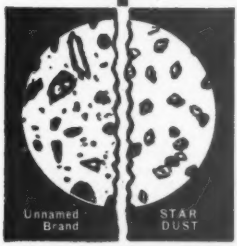
"How to Use HARD-N-TUFF" is an informative folder offered by Doughty Laboratories, Inc. It fully describes how this steel hardening compound provides fast, effective, three-way action: carburizing, nitriding and chromizing.
Circle Inform-A-Gram No. B10.

You're LAPS AHEAD with ACE Star Dust

DIAMOND LAPPING COMPOUNDS AND DIAMOND POWDERS

Laboratory Grading Does it!

MIRROR FINISHES IN MINUTES ON DIES, TOOLS, MOLDS AND PRECISION PARTS



ACTUAL MICROPHOTOS PROVE STAR DUST SUPERIORITY AT A GLANCE . . .

STAR DUST is so accurately crushed and graded by Ace's new laboratory method that it achieves uniform nodular shape, permitting all particles to work. Thus you are assured finishes of less than half a micro inch, quicker than ever before. By contrast, note lack of uniformity and the flats in the "unnamed" brand that prevent accurate finishing!

● STAR DUST USERS REPORT AVERAGE SAVINGS IN POLISHING TIME OF MORE THAN 75%: Available in ophthalmic-tipped tubes or in new applicator gun that delivers minimum quantities to individual jobs and eliminates all waste . . . In all grit sizes as fine as .0001".

Write today for informative bulletin No. C-4

Delivery from from stock in most sizes!

ACE ABRASIVE LABORATORIES | 250 WEST 57th STREET NEW YORK 19, N. Y.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

A Complete Listing of stocked sizes and shapes of Carboloy Alnico permanent magnets is included in Bulletin PM-100, now available. The 20-page, illustrated catalog contains pull curve and size information in tabular form on stocked types of Alnico permanent magnets, both cast and sintered, as well as size and application data on stocked holding assemblies. A list of available patterns for various sizes of cast Alnico bars, blocks, rods, rings and sleeves is included. Address CARBOLOY Dept. of General Electric Co., 11111 E. 8 Mile Rd., Detroit 32, Mich.
Circle Inform-A-Gram No. B11.

Full Details and Dimensions on Lamina Guide-Pin Bushings are given in an illustrated bulletin. This publication also contains information on a variety of other Lamina tools, dies and diemaking equipment.
Circle Inform-A-Gram No. B12.

Micro Supreme Lay-out and Identification Dye is available in 13 colors for quick identification of bar stock, sheet, strips or parts. It shows up in sharp relief—drys instantly. A descriptive circular and sample will be furnished by the manufacturer, Michigan Chrome & Chemical Co.
Circle Inform-A-Gram No. B13.

FEDERAL PRESSES
27 YEARS OF QUALITY CONSTRUCTION
Smoother, Faster
More Accurate Operation
Federal Presses with new Smooth-Air clutch are controlled electro-pneumatically. Void of mechanical linkage. May be "inched", single-tripped, or operated continuously. Built of finest materials, working parts are carefully machined, fitted and aligned for balanced power at any operating speed. 6 to 80 tons. Write for catalog.
THE FEDERAL PRESS CO.
507 Division St., Elkhart, Ind.

Leinen Precision Lead Screw & Feed Shaft Lathes are described in a catalog sheet offered to T&P readers. These German-made lathes have the following features: draw-in collet attachment; fine feed attachment; headstock completely covered with single step driving pulley; main spindle relieved of belt pull; and electric-motor drive-arrangement equipped with special coupling of lamination segment. Complete specifications are listed. GUTHERY MACHINE TOOL CORP., 130 W. 42nd St., New York 18, N. Y.
Circle Inform-A-Gram No. B14.

A New Corrosion-Resistant Coating for Detrex degreasers has been developed, according to literature from the manufacturer. This non-porous phenolic type coating, which is called Detrex FF-1, is now being used for coating the inside of the company's standard line of VS-800, hand-operated, solvent-vapor degreasers. Complete details can be had from DETREX CORP., Box 501, Detroit 32, Mich.
Circle Inform-A-Gram No. B15.

A Gaging System developed to measure cam contours, both angle and amount of eccentricity, by direct reading optical means, is detailed in a Griswold bulletin. The Optical Cam Rise Gage, pictured in the bulletin, can be used to make measurements at any angle of arc directly and quickly just by rotation of a microscope dial. Readings to four decimal places are readily determined. F. T. GRISWOLD MFG. CO., 305 W. Lancaster Ave., Wayne, Pa.
Circle Inform-A-Gram No. B16.

A New Catalog illustrating and describing the Studer PSM-250 Profile Grinder is available from Cosa Corp., U. S. distributor. This machine grinds profiles up to 16" in just one setting. Larger flat or circular form tools, section dies, gages and other profile parts can be handled.
Circle Inform-A-Gram No. B17.

Many Time Saving Press Accessories are illustrated and described in Catalog No. 51. Included are roll, dial, and hopper feeds; straightening and feeding machines; oilers and stock tables; reels and coil cradles; and various air operated accessories. F. J. LITTELL MACHINE CO., 4145 Ravenswood Ave., Chicago 13.
Circle Inform-A-Gram No. B18.

Fast, Accurate Routing of wood, plastics, and non-ferrous metals can be economically performed with Onsrud air turbine motors and routers, which are completely described and illustrated in new Bulletin 1138. Motors are precision built, with capacities ranging from ¼ hp to 2 hp, and speeds of 22, 30, or 50 thousand rpm. Portable routers come in kit form, ready for use. Various attachments and accessories are available. ONSRUD MACHINE WORKS, INC., 3941 Palmer St., Chicago 47.
Circle Inform-A-Gram No. B19.

Self-Lubricating Sleeve Bearings and other moving parts are illustrated in new factual folder. Specifications of most commonly-used sizes of porous sleeve bearings are given. Also included are specifications of various porous compositions in which bearings or other powder metal parts can be obtained. DETROIT SINTERED METALS CORP., 75 E. Wacker Dr., Chicago 1.
Circle Inform-A-Gram No. B20.

The Latest Issue of Ampco Welding News includes a well-illustrated article discussing the welding techniques used in fabricating sulphuric acid sludge tanks 24 ft. in diameter. The uses of various resistance welding techniques for increased weld quality plus case histories of overlaying electric furnace trunion shafts and repairing cast iron buckets with Ampco-Trode electrodes are included. For a copy of this informative issue, write to AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 46, Wis.
Circle Inform-A-Gram No. B21.

A Catalog and Tracing Templates for Lodding clamps and details are now available from Lodding, Inc.
Circle Inform-A-Gram No. B22.

Tap Grinding Machines and attachments made by Meteor, Ltd., Zurich, Switzerland, are described in literature available from Carl Hirschmann Co. This equipment is for converting twist drill grinders so that they will sharpen the tapered start of all the usual taps for right-hand and left-hand threads. CARL HIRSCHMANN CO., 30 Park Ave.., Manhasset, N. Y.
Circle Inform-A-Gram No. B23.

The New Clausing Heavy Duty 16" Drill Press is described in a catalog published by Clausing Div., Atlas Press Co. The publication details the outstanding features of this general purpose drill for production, tool room, maintenance and service shops.
Circle Inform-A-Gram No. B24.

Mall Pneumatic Die Grinders, with a guaranteed speed of 30,000 rpm and a maximum of .0015" runout at the collet, are featured in a new bulletin and price list covering the complete line of Mall Tool Company's pneumatic power tools.
Circle Inform-A-Gram No. B25.

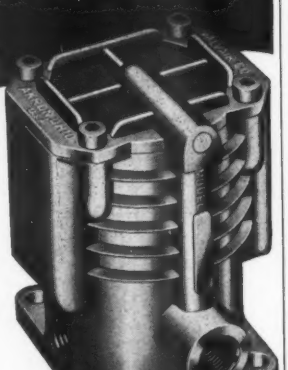
MORE THAN A "COOLANT" IS NEEDED
"COOLANT" is a misnomer as applied to *cutting fluids*. You won't get far with just a coolant. The fluid used for metal cutting must have multiple characteristics in order to provide the desired finish and tool life at the required production rate:
• Cooling Action—necessary to carry away the heat generated by machining, but only part of the function.
• Lubricity—to reduce friction between the tool and the work piece.
• Anti-Weld Properties — to prevent build-up of metal on the tool and scuffing of the work piece.
These factors and others are all inter-related. Over-simplification of the subject and the cutting fluid can lead to trouble.
Let a Stuart sales-engineer show you what can be accomplished with the *right* cutting fluid. *Ask for Bulletins.*
Time-Tested CUTTING FLUIDS
D.A. Stuart Oil CO.
2729-37 S. Troy Street, Chicago 23, Ill.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Comprehensive Selection of Small Tools is described and illustrated in 224-page Catalog No. 35, which with related price list constitutes a helpful buyer's guide to machinists' tools, gages, milling cutters and hobs, arbors, adapters, collets, screw machine tools, pumps, permanent magnet chucks, vises, mandrels, and many other essential items of shop equipment. This new large-sized catalog, which is far more complete and easier to use than its predecessors, is available from BROWN & SHARPE MFG. CO., 235 Promenade St., Providence 1, R. I.
Cirlce Inform-A-Gram No. B26.

Maximum Versatility and Precision in Milling are benefits offered by Fray universal ram turret type milling machines—No. 10-RH Vertical and Horizontal, and No. 10-R Vertical, built to toolroom standards. Milling, drilling, or boring operations can be done at any angle in either or both the vertical and horizontal planes. Vertical and horizontal milling can be done separately, or at the same time. Turret can be rotated 360°. Many other features are described in Bulletins 10-R and 10R-H. FRAY MACHINE TOOL CO., 515 W. Windsor, Glendale 4, Cal.
Cricle Inform-A-Gram No. B27.

The *New* VALVAIR
SOLENOID PILOT VALVE



All This at a Low Price!

- OVER 20,000,000 CYCLES
- CORROSION-PROOF
- NO OVERHEATING
- MANIFOLD MOUNTING AVAILABLE

SIZE:
¼" pipe tap,
orifice ⅛"
or 3/16".

Write for our new Bulletin X-4.

The NEW Valvair Solenoid Pilot Valve is offered in 2-way and 3-way models, normally open or normally closed. Coils are completely sealed. Only two moving parts: spring and plunger. Valve life is almost unlimited.

VALVAIR CORPORATION, 952 Beardsley Ave., Akron 11, O.
AFFILIATE: SINCLAIR-COLLINS VALVE CO.

Rely Upon Valvair 2-WAY 3-WAY 4-WAY

Extending the Life of Critical Machine Parts that are exposed to unusual abrasion, corrosion, or high temperature conditions, is often possible by use of cast or wrought cobalt-, iron-, and nickel-base alloys. New 24-page booklet presents 60 blueprints, tables, and photos showing some of the many sizes and shapes in which these Haynes alloy parts are being used. HAYNES STELLITE CO., Div'n of Union Carbide and Carbon Co., P. O. Box 746, Kokomo, Ind.
Circle Inform-A-Gram No. B28.

Precision on Rugged Planing Jobs is offered by modern Martin planer, built for higher speeds, greater rigidity, and strength. Pyramid housings, double balanced gear train for reduced torsional strains, positive and electrically operated feeds, forced lubrication system, stationary screws that absorb greater side thrust, independent side heads, and pneumatic tool lifers are among the many exceptional features offered. Write for Bulletin 501 to Hamilton Div'n, CLEARING MACHINE CORP., 999 Laurel Ave., Hamilton, O.
Circle Inform-A-Gram No. B29.

Good Brazing Strength in joining titanium, zirconium, and their alloys is now possible with a special brazing flux, which permits use of low temperature silver brazing alloy. Embrittlement as well as oxygen and nitrogen contamination can thus be minimized. Descriptive literature is available from HANDY & HARMAN, 82 Fulton St., New York 38.
Circle Inform-A-Gram No. B30.

Streamlining of Product Design, when c'sinking is impractical, is aided by use of button head socket cap screws, described in new folder. These completely cold-forged screws —available in various standard sizes—feature thin heads, non-deforming sockets, and exceptional strength. THE HOLO-KROME SCREW CORP., Hartford 10, Conn.
Circle Inform-A-Gram No. B31.

A 36-Page Catalog describing and illustrating its complete lines of Hydro-Dynamic Presses has been published by E. W. Bliss Co. It includes sections devoted to single-action housing and open-rod presses, double-action housing and open-rod presses, special function presses, material handling devices and hydraulic cushions. Write to E. W. BLISS CO., 1375 Raff Rd., Canton, Ohio, and ask for Catalog No. 30-A.
Circle Inform-A-Gram No. B32.

An Improved Automatic "Bend-Ex" Tube Bending Machine is presented in a recently released brochure. The publication illustrates the three quick steps in setting up this air compression type bender. Write to the manufacturer, PAUL MACHINE TOOL & DIE WORKS, 4600 S. Kedzie Ave., Chicago 32, Ill., for a copy of the brochure.
Circle Inform-A-Gram No. B33.

NORECO Concentrated Oil Additives are presented in a new pamphlet. NORECO 216 is an improved, chemically compounded, friction-reducing oil additive that increases the performance of lubricating, cutting and grinding oils and coolants. The primary principle is to restore to these fluid lubricants the rugged oiliness lost in modern refining due to product diversity, plus adding ingredients to meet the demands of increased production. Write to the manufacturer, NORECO OIL CORP., 20 W. 43rd St., New York 18, N. Y.
Circle Inform-A-Gram No. B34.

A Comprehensive Contour Machining Brochure has been issued by DoALL. This 16-page booklet explains the advantages and manufacturing short cuts possible by contour machining with band tooled machines. There are many illustrations of machine models and applications, along with information on accessory and tool selection. THE DoALL CO., Dept. T&P, 254 N. Laurel Ave., Des Plaines, Ill.
Circle Inform-A-Gram No. B35.

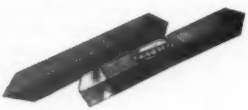
The Brightboy Catalog Manual describes a number of time-saving methods and procedures involving abrasive finishing. Rubber-cushioned abrasives for burring, cleaning, finishing and polishing are featured. Write to Brightboy Industrial Div., WELDON ROBERTS RUBBER CO., Sixth Ave., & N. 13th St., Newark 7, N. J.
Circle Inform-A-Gram No. B36.

A New Booklet on Comparator Charts and fixtures is now being mailed by Gage Company. Address GAGE CO., Dept. T&P, Battle Creek, Mich., and ask for Bulletin 51-2497.
Circle Inform-A-Gram No. B37.

Conversion of a Hand-Operated Lathe to an automatic with resultant savings in production time can be quickly made with the Newton Automat, a simplified but efficient fully mechanical unit which is actuated by the lead screw exactly as driven by present power source. Sensitive clutch saves work if tool should break or cutting pressure become excessive. Standard cams are easily adjustable for most work. Pneumatic collet operation is provided for. Descriptive booklet is available from A. K. TOOL COMPANY, 2029 Blake Ave., Los Angeles 26.
Circle Inform-A-Gram No. B38.

ARMSTRONG
CUTTER SERVICE

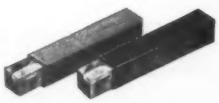
Whatever the cutting speed you need, no matter what the material to be machined, the ARMSTRONG System of Tool Holders provides correctly designed ARMSTRONG TOOL HOLDERS and cutters of proper type for the job.



For ordinary machining at the speeds indicated, we recommend:

up to **150 f.p.m.**
ARMSTRONG HIGH SPEED Bits, Blades or Cutters in standard ARMSTRONG TOOL HOLDERS.

up to **300 f.p.m.**
ARMALLOY (cast alloy) Bits and Blades in ARMSTRONG *CA* TOOL HOLDERS.



up to **600 f.p.m.**
ARMIDE (Carbide-Tipped) Cutters in ARMSTRONG *Carbide* TOOL HOLDERS.

Armstrong Tools are stocked by Industrial Distributors

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W. ARMSTRONG AVE. • CHICAGO 30, U.S.A.
Eastern Warehouse and Sales Office
100 Lafayette St., New York, N. Y.
Western Warehouse and Sales Office
1275 Mission St., San Francisco, Calif.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Magnaflux Laboratory Inspection Service is available to those plants which do not have complete inspection facilities. Commercial Laboratories are maintained in 11 key industrial centers for the nondestructive testing of product components. Cracks, porosity, faulty welds, blow holes, and improper stress distribution are among the many conditions which can be located and analyzed. Descriptive brochure, "Profit or Loss", is available from MAGNAFLUX CORP., 5900 Northwest Highway, Chicago 31.
Circle Inform-A-Gram No. B39.

Industrial Freezers for Heavy-Duty Service at temperatures as low as —165° F. Lowest temperatures are held constant with extreme accuracy. Freezers are available in 36 standard models, or custom-built, to meet any industrial requirement ranging from production line work on shrink and fit assembly, through toolroom's stabilization of metal, to laboratory uses. Literature is available from Industrial Freezer Div'n, WEBBER APPLIANCE CO., INC., 2740 Madison Ave., Indianapolis 3, Ind., describing various models and their uses.
Circle Inform-A-Gram No. B40.

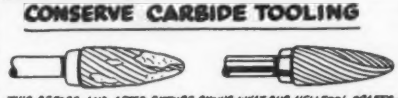
Severance Regrinding Service

RECONDITIONING TO NEW-TOOL PERFORMANCE AT A FRACTION OF NEW TOOL COST!

☆ HIGH SPEED and CARBIDE ☆

Why take less?-- for Safety, Efficiency, Economy-- insist on genuine factory reconditioning service performed by Severance New Tool Craftsmen!

CONSERVE CARBIDE TOOLING



THIS BEFORE AND AFTER PICTURE SHOWS WHAT OUR NEW-TOOL CRAFTSMEN CAN ACTUALLY DO WITH YOUR BATTERED CARBIDE TOOLS OF THIS AND SIMILAR TYPES

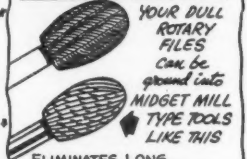
CONSERVE THROUGH REGRINDING

REPRESENTS A NEW SEVERANCE MIDGET MILL (HIGH SPEED OR CARBIDE)

REPRESENTS THE SAME TOOL AFTER 20 REGRINDS

YOUR DULL CUTTERS ARE REGROUND BY SEVERANCE NEW-TOOL CRAFTSMEN

CONSERVE THROUGH SALVAGE



YOUR DULL ROTARY FILES Can be ground into MIDGET MILL TYPE TOOLS LIKE THIS

ELIMINATES LONG DELIVERY WORRIES-- Saves Your Dollars!

We're the Originators

OVER 20 YEARS EXPERIENCE IN THIS MONEY SAVING SERVICE

★ We've been copied but not surpassed ★

DEPENDABLE DELIVERIES ARE ASSURED ★ THROUGH SEVERANCE REGRINDING SERVICE

We Regrind: MIDGET MILLS, ROTARY FILES, BURS, FILE BANDS, COUNTERBORES, COUNTERSHANKS, ETC.

SEND YOUR DULL CUTTERS TO

SEVERANCE TOOL INDUSTRIES INC.
730 IOWA AVE., SAGINAW, MICH.

Catalog Including Regrind Prices Sent on Request.

An Oil-Retaining, Rustproof Surface on moving metal parts is produced by chemical treatment, using Rustshield 2, a phosphatizing compound. Booklet describes uses and advantages of using this process on sliding and revolving bearing surfaces. Full information on this simple, non-electrolytic immersion process can be obtained from OCTAGON PROCESS, INC., 15 Bank St., Staten Island 1, N. Y.
Circle Inform-A-Gram No. B41.

A Two-Color Catalog, recently published by Jergens Tool Specialty Co., profusely illustrates the complete Jergens line of mass-produced jig and fixture components. Illustrated and described are key-note samples of the more than 375 component parts in the Jergens line, plus hand wheels, lever knobs, clamp assemblies, chuck jaw blanks and sine fixture keys. JERGENS TOOL SPECIALTY CO., Dept. T&P, 712 E. 163rd St., Cleveland 10, Ohio.
Circle Inform-A-Gram No. B42.

Portable Coolant System for all types of machine tools feature corrosion-resistant, impeller type centrifugal pump that will handle liquids safely up to 285° F; heavy-gauge steel tanks treated for corrosion resistance; removable filter screen and baffles; heavy duty, moisture-resistant, fan-cooled motor; neoprene and flexible steel hoses with regulator valve. Write for data sheet to de CASTRO & ASSOCIATES, 1515-17 Santa Fe Ave., Los Angeles 21, Cal.
Circle Inform-A-Gram No. B43.

"Cincool Defeats Heat" is a beautifully-illustrated booklet describing how this Cincinnati Milling multi-purpose cutting fluid can give you lower metal cutting costs. Write for this informative 12-pager, Publication No. M-1757, to Cincinnati Milling Products Div., THE CINCINNATI MILLING MACHINE CO., Dept. T&P, Cincinnati 9, Ohio.
Circle Inform-A-Gram No. B44.

A New Formulation of the original MICRONOIL GAGE-LUBE lubricant, for precision gages and other close tolerance surfaces, is claimed by the manufacturer to extend the use-life of such instruments by 500% to 1000%. Complete information is obtainable from the manufacturer, PROTECTIVE COATINGS, INC., P. O. Box 57, Strathmoor Station, Detroit 27, Mich.
Circle Inform-A-Gram No. B45.

Open Back Inclinable Power Presses provide the subject matter for attractively illustrated Bulletin No. 215, just released by Clearing Machine Corp. Geared and non-geared presses are covered in the 16-page booklet. Important design and construction features are labeled on drawings of smaller and heavier size presses. The bulletin also includes dimensions, specifications and other data. CLEARING MACHINE CORP., 6499 W. 65th St., Chicago 38, Ill.
Circle Inform-A-Gram No. B46.

Selection of Heat-Treating Furnace to meet a particular problem is the subject of a new 38-page booklet, "Harnessing Heat". Various types of furnaces—both gas and electric—are described as to their chief field of application. One section describes the four basic types of protective atmospheres available and defines range of use. For this booklet, B-5459, write WESTINGHOUSE ELECTRIC CORP., Box 2099, Pittsburgh 30, Pa.
Circle Inform-A-Gram No. B47.

A Complete Line of Etalon Measuring Tools is described in Alina Corporation's 16-page catalog. Descriptions and illustrations of the following Swiss-made tools are included: vernier calipers of various kinds, vernier depth gages, vernier height gages, universal bevel protractors, super micrometers and dial micrometers. Write ALINA CORP., 32 Broadway, New York 4, N. Y.
Circle Inform-A-Gram No. B48.

A Compact Folder just issued by Northwestern describes the 167 sizes of jig and fixture components that are available for immediate delivery. For a copy of Catalog No. 20, address NORTHWESTERN TOOL & ENGINEERING CO., 116 Hollier Ave., Dayton 3, Ohio.
Circle Inform-A-Gram No. B49.

Layout and Inspection Time can be shortened with the Universal Angle Computer. Descriptive literature is procurable from Angle Computer Co., Inc.
Circle Inform-A-Gram No. B50.

Instruments, control devices and related components are described in Composite Catalog No. 5000 of Minneapolis-Honeywell. Specifications of approximately 100 measuring and control instruments and valves are outlined in this illustrated, 28-page booklet. Several new designs, including the Differential Controller and Tel-O-Set Controller Family are featured. MINNEAPOLIS - HONEYWELL REGULATOR CO., Brown Instruments Div., Station 40, Wayne & Windrim Aves., Philadelphia 44, Pa.
Circle Inform-A-Gram No. B51.

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Scully-Jones "Roll-Lock" Chucking Tools (mandrels, arbors and chucks) are presented in new Bulletin No. 17-50. Illustrations, a detailed description and technical data are included.
Circle Inform-A-Gram No. B52.

A Vest Pocket Folder describes briefly all Logan lathes. These lathes are quickly and easily set up for any type of operation—a heavy cut, a tool room precision job, a high speed production run, or large volume second operation work. Logan Engineering Co. is mailing copies.
Circle Inform-A-Gram No. B53.

Werner Milling Machines—both multi-purpose and manufacturing—are described in an illustrated eight-pager from Marac Machinery Corp. Descriptions, specifications and accessories are given. Write to MARAC MACHINERY CORP., 1819 Broadway, New York 23, N. Y.
Circle Inform-A-Gram No. B54.

Wales Fabricators are the subject of fully illustrated, functionally colored Catalog 10-A. Unique design and operation features are pointed out in this publication of Wales-Strippit Corp.
Circle Inform-A-Gram No. B55.

"Lubri-Cut" is a new special cooling and lubricating agent that increases production output and also increases the life of taps, drills and other cutting tools. This fire-resistant, patented compound is free from all abrasives and acids. "LUBRI-CUT" is available in both paste and semi-paste form. Free samples and complete information are procurable from TAP & DRILL E-Z Corp,. 11033 Hawthorne Blvd., Inglewood, Calif.
Circle Inform-A-Gram No. B56.

An Extensive Press Brake Catalog has been issued by Verson Allsteel Press Co. This 21-page booklet has illustrations, design details and specifications of the complete line of Verson press brakes with capacities of from 15 tons up. Both mechanical and hydraulic types are covered. Write for a copy to VERSON ALLSTEEL PRESS CO., 9300 S. Kenwood Ave., Chicago 19, Ill.
Circle Inform-A-Gram No. B57.

Uniform Color and Fnish in Barrel Tumbling of non-ferrous parts is obtained by use of Blue Magic No. 1 double strength compound, which yields beautiful results in brief time cycle. Eliminates timing as a critical factor. Bulletin No. 1 describes advantages and recommended uses of this new compound in descaling, roughing, deburring, cleaning, and finishing a wide range of metals. BLUE MAGIC CHEMICAL SPECIALTIES CO., 2135 Margaret St., Philadelphia 24, Pa.
Circle Inform-A-Gram No. B58.

Facilities for Fabrication of Sheet Metal Products are described in new 20-page booklet. In addition to defining available services and range of operations performed, the booklet includes a complete list of all equipment and machinery available at the Lyon plants in Aurora, Illinois and in York, Pennsylvania. For a copy of "Craftsmen in Sheet Metal Production", write to LYON METAL PRODUCTS, INC., Aurora, Ill.
Circle Inform-A-Gram No. B59.

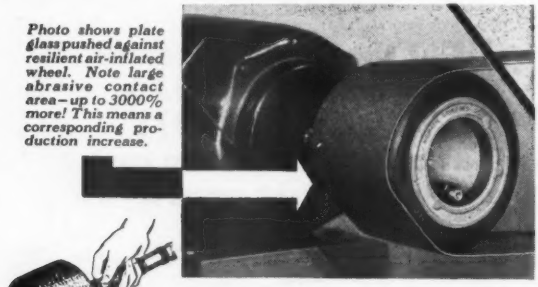

Photo shows plate glass pushed against resilient air-inflated wheel. Note large abrasive contact area—up to 3000% more! This means a corresponding production increase.

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send for full information TODAY!

NU-MATIC Air-Inflated GRINDERS

Basic Design of Fluid Power Circuits is explained in an easily-understood manual, which shows representative types widely used. An index of pneumatic and hydraulic symbols is included. This 32-page, pocket-size manual will be a big help to most men responsible for increasing machine and man productivity. For a copy of "The Circuit Rider", write to LOGANSPORT MACHINE CO., Logansport, Ind.
Circle Inform-A-Gram No. B60.

Time Savings on Simple Bench Operations can often be gained through use of new Rapistan Table-Veyor which features a horizontal belt conveyor running the length of the table between two foot-wide working surfaces. Assembly operations, sorting, packing, checking, inspecting and many similar jobs can now be speeded up by eliminating the need for individual workers to walk around to obtain or get rid of work material. Available in lengths of 10' to 60', in multiples of 5', and with or without casters for portability or permanence as desired. Write for Bul. TV-52 to THE RAPIDS-STANDARD CO., INC., Grand Rapids 2, Mich.
Circle Inform-A-Gram No. B61.

Bearing Surfaces Finish-Peened and Sized to extreme accuracy by Cogsdill "Bearingizing" process, which involves the application of a tool that produces a series of rapid-fire blows at the rate of 200,000 or more per minute by means of high-speed, cam actuated peening rolls. Adaptable to both interior and exterior surfaces on a wide range of metals having suitable ductility. Work surface is compressed and slightly hardened; peaks are driven into valleys; mirror-like burnished surface is achieved. Friction is reduced, life increased, corrosion resistance and wear resistance are increased. HOLE ENGINEERING SERVICE, P. O. Box 4877, Detroit 19.
Circle Inform-A-Gram No. B62.

Increased Productivity on Tapping operations is provided by Procunier high speed tapping heads, described and illustrated in the new Bulletin 101. In addition to the well established and better known tapping heads, the "Tap King" —a heavy duty attachment for large size taps—is offered. Also included is the new "Tru-Grip" tap holder (now standard equipment on Procunier tapping heads) for reduced tap breakage and increased tapping accuracy. A copy is available from PROCUNIER SAFETY CHUCK CO., 18 So. Clinton St., Chicago 6.
Circle Inform-A-Gram No. B63.

Arc-Welding Accessories are described in three new illustrated bulletins. These describe recommended protective clothing (Bul. GEC-867), helmets and glass (Bul. GEC-865), brushes, carriers, chipping hammers, paint and weld-spatter compounds, and weld gages (Bul. GEC-866). Write to GENERAL ELECTRIC COMPANY, Schenectady 5, N. Y.
Circle Inform-A-Gram No. B64.

Six Models of Kenco Power Presses are described in literature from the California manufacturer. "Big press" features of these small presses are outlined.
Circle Inform-A-Gram No. B65.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Power Presses, Inc., offers a service manual and technical data on their combination air-operated clutch and spring-operated friction brake. The service manual gives instructions for general care and maintenance. POWER PRESSES, INC., Dept. T&P, Penton Bldg., Cleveland 13, Ohio.
Circle Inform-A-Gram No. B66.

Abrasive No. 3B Surface Grinder is excellent for grinding such defense production parts as jet turbine blades. Complete details on this power grinder can be had from Abrasive Machine Tool Co.
Circle Inform-A-Gram No. B67.

A Single New-Field Universal Fly Cutter, utilizing any type of standard high speed steel or carbide bits, makes multiple milling cuts in one operation. Details are obtainable from New-Field Machined Parts Co.
Circle Inform-A-Gram No. B68.

The New Columbia No. 2 Vertical Milling Machine is described in a four-page, illustrated catalog published by the manufacturer, Columbia Enterprises Corp. This new miller incorporates all the advantages of the No. 1 model, plus many new features.
Circle Inform-A-Gram No. B69.

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With built-in variable flow control valve in head. Positive displacement piston type. Displacement capacity: 2 gal. per min. at 1500 RPM or 1250 PSI. Pressure limit 1250 PSI continuous. 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotates either direction without adjustment . .
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Double action. Bore is 1" — Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs.
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P-4 VICKERS ANGLE PUMP
Positive displacement type, angle piston. Displaces .507 cu. in. per revolution. Max capacity of 6 gal. per min. at 3000 RPM at 1500 PSI., continuous, 1875 for 15 sec. Operating speed of 3750 RPM, intermittent maximum, 4500 RPM. Rotates to the right only.
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FOUR WAY VALVE
Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. 5/8" AN tube size (7/8"-14 thread) inlet & outlet. Ports to cylinder are 1/2" AN tube size 3/4"-16 thread).
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A Safe and Effective Water-Miscible Coolant has been developed that extends tool life, improves work quality, and is non-offensive to the machine operator. "Trim" is free from bacteria growth, non-harmful to operator's skin, free from offensive odors, and non-gumming. It has high lubricity qualities (higher than some oils), and is an effective rust inhibitor even on steels. It has been used with amazing results on such materials as Inconel, high-temperature stainless, titanium and other hard-to-machine materials. For literature, write to MASTER CHEMICAL CORP., 538 Erie St., Toledo 2, O.
Circle Inform-A-Gram No. B70.

Sustained Accuracy in Inspection and Toolroom Layout work is ensured with use of Norton ceramic surface plates, now finished to a new precision standard of continuous smoothness. Friction-free plate permits easy movement of instruments without drag or vibration. This quality, coupled with high resistance to wear, prevents wear on expensive instrument bases, gage blocks, and sine bars. Ceramic plates are non-corrosive and non-magnetic. Write for literature to NORTON COMPANY, Worcester 6, Mass.
Circle Inform-A-Gram No. B71.

Fast and Accurate Production Control is available to any manufacturer, regardless of size, through utilization of facilities offered by Business Service Department of Remington Rand, Inc. The speed and accuracy of punched card accounting is provided to the small or medium-sized plant without any cash outlay necessary for equipment or additional personnel. Facts and figures are quickly compiled for use in sound materials purchasing, inventory control, cost accounting, machine and man scheduling, etc. Descriptive folder, BSD-6, can be obtained from REMINGTON RAND, INC., 315 Fourth Ave., New York 10.
Circle Inform-A-Gram No. B72.

Precision in Millionths is inherent in the Fonda line of Lifetime-Carbide and steel gage blocks, which are lapped by a machine process providing a sustained dimensional acuracy, flatness, and parallelism that exceeds specifications of the U.S. Bureau of Standards. Lifetime-Carbide blocks offer exceptional wringability as well as stability. Blocks are catalogued and described in new 1952 catalog. THE FONDA GAGE CO., INC., 59 Daly St., Stamford, Conn.
Circle Inform-A-Gram No. B73.

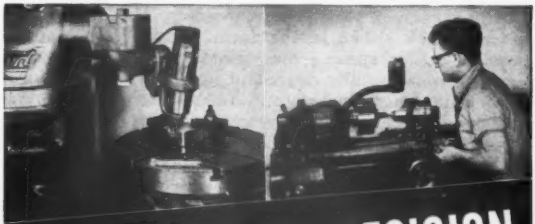
Standard Carbide-Tipped Tools for universal shop use are illustrated, specified, and priced in the new Supplement No. 5 Catalog No. 50. Included are Styles A through G single point lathe tools for turning, facing, threading, and boring; also, various standard boring bits with round, half-round, and square shanks. SUPER TOOL COMPANY, 21650 Hoover Rd., Detriot 13.
Circle Inform-A-Gram No. B74.

High Speed, Tool, and Die Steel application data, heat treatment recommendations, weight tables, and other helpful information is offered in newly revised "Latrobe Pocket Handbook". Steels included are various Electrite high speed steels; non-deforming die steels; oil hardening die steels; hot work die steels; punch, chisel, and shock steels; die casting die steels; water hardening and carbon tool steels. Write to LATROBE ELECTRIC STEEL CO., Latrobe, Pa.
Circle Inform-A-Gram No. B75.

Precision Toolroom Lathes, with 14½" swing, are fully described in Bulletin 5201. These lathes are job-tested before leaving the factory to make certain that they will turn, bore, face, and thread to tolerances far more precise than are usually required for the finest tool and gage work. SOUTH BEND LATHE WORKS, 425 E. Madison St., South Bend 22, Ind.
Circle Inform-A-Gram No. B76.

Increased Tool and Product Life is gained by use of "Hard-N-Tuff" hardening compound, which quickly and inexpensively produces an improved quality in steel, with a maximum depth of hardness. High-speed-steel service is often obtained from ordinary carbon steels. Non-toxic, this compound is easy to use. Small parts can be hardened with gas or acetylene torch. Open furnace or forge is recommended on larger parts in order to get an even distribution of heat. DOUGHTY LABORATORIES, INC., 500 Fifth Ave., New York 18.
Circle Inform-A-Gram No. B77.

Magnetic Hand Tools, powered by lifetime permanent magnets, provide safety and savings in a wide range of handling, salvaging, sorting, detecting, loading, holding, and other everyday shop operations. Sixteen, hand-operated permanent-magnet tools are illustrated, specified, and priced in new Technical Bulletin M-30. Tools employ no external power source, are shockproof and convenient to use. Several are of entirely new design, performing new uses not heretofore known. Magnetool Div'n, Dept. 537, MULTIFINISH MFG. CO., 2114 Monroe, Detroit 7.
Circle Inform-A-Gram No. B78.



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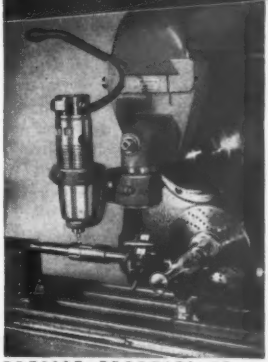

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Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¾ HP; speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

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PRECISE GRINDER-MILLERS

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Copper Alloys, from page 118
alloy has between 1.85 to 2.15 percent beryllium; where less than the minimum specified is used, a considerable reduction in the properties will be experienced.

Conversely, where the beryllium content rises above 2.15 percent, there is no appreciable improvement in the mechanical or physical properties and some difficulty may be experienced in rolling or during fabrication. It is often common practice to specify additional constituents for this binary alloy; cobalt being frequently used as an additive to obtain high temperature stability and nickel being added for the purpose of retarding grain growth.

In the first phase of heat treatment, namely solution heat treatment, a temperature of 1350 to 1475 deg. Fahr. is usually employed which is followed by a water quench either in the form of immersion or by spray. The selection of temperature is usually dependent upon the bulk weight of the item. Immediate quenching is desirable since any delay in time between the furnace and the quenching medium will result in inferior properties, self-evident after the subsequent aging treatment.

The aging or precipitation hardening treatment which follows is a function of both time and temperature; the higher the temperature of treatment the lower will be the time factor. Thus, the temperature range usually specified is between 500 and 700 deg. Fahr., however the usual range employed is between 600 and 625 deg. Fahr. for a time period of from one to three hours. Temperatures above 625 deg. Fahr. can be employed; however, the time period will be reduced to an hour or even as low as 10 minutes.

This reduced time factor may be so critical that considerable skill is required to obtain consistently good results, hence practices such as this should be discouraged. If heating is continued over too long a time period or if the temperature of treatment is too high, a condition of "overaging" or resoftening will result.

The aging treatment can be accomplished in either the conventional batch or continuous type furnace, utilizing a dry atmosphere, or in a molten salt bath. The principal difference between the two heating mediums is the rate of heat transfer; the salt bath usually requiring from one-half to two-thirds the time required in a conventional type of furnace.

In the use of either a batch or a continuous furnace, a controlled atmosphere such as hydrogen is strongly recommended. Under ordinary conditions, a scale will form which can be readily removed. The scale is "binary" in character; an outer scale which is dark and a scale reddish in color directly beneath it.

The outer scale is readily removed in a hot solution containing two parts of commercial sulfuric acid to one part of water; the time of immersion being of little consequence.

The reddish-colored scale is removed by immersion in a solution containing one part of commercial sulfuric acid, seven parts of water and 3 ounces per gallon of solution of sodium dichromate. This latter solution is operated cold and the time of immersion is quite critical; this solution having a marked corrosive effect on the alloy and pitting may result if the parts are immersed too long. Agitation is also recommended for this solution and immediate washing in hot water after pickling is done.

Parts that are heat treated in a salt bath can be cleaned in hot water followed by a pickling cycle as described above.

In many instances, better mechanical properties can be realized by the judicious use of material which has been previously cold worked; the permissible amount of cold working being dependent upon the nature and extent of forming to be done to make the completed item. Normally, material in the half hard condition is used for the fabrication of most stampings; however, under conditions where any radius in blanked and formed parts is less than three times the thickness of the material or where wire having sharp bends is used, the annealed material is usually required.

Coil springs that are fabricated from three-quarters hard material will have better fatigue properties than those fabricated from half hard material.

In the manufacture of flat stampings where no bending or forming is done, the full hard material can be used with subsequently higher mechanical properties. The relationship of tensile strength of heat treated beryllium copper to the initial

(Continued on page 176)

. . . Hi-Jet, from page 121

be greatly reduced. And because the tools last longer, fewer tools are needed. On large production jobs this means substantial savings in tool inventory and tool cost.

Because of the improved cooling and lubricating action on the tool radius, surface finish is greatly improved with this new method. Test results have shown a reduction in surface roughness from 200 to 60 microinches (rms). Even where improvements in surface finish are not so pronounced, greater dimensional stability usually results; the effects of tool build-up and radius wear are practically eliminated.

An important advantage of the improved surface finish and dimensional accuracy on work machined with Hi-Jet is the reduced need for additional finishing operations. In some cases the finishing operation can be entirely eliminated. Grinding time, too, can often be reduced because of the smaller dimensional variations. Also there is less tendency toward work hardening of the machined parts. On some jobs this may mean that stresses which cause distortion and surface hardening are reduced.

★ ★ ★

Timken Roller Bearing Production Up for 1951

1950 production records were shattered last year, according to officials of The Timken Roller Bearing Company. In spite of cutbacks in the automotive industry, 1951 production levels reached an all-high. Increased demands by the tool machine industry for high precision bearings helped to offset the cutbacks in the automotive industry. Tool machine demand was up due to increased demands for defense materials. Miscellaneous items manufactured by Timken, such as dust collars, oil seal rings, rock bits, and thrust bearings, kept pace with the increased production of precision bearings.

"Nassovia" Die Sinker

Arrangements for stocking complete machines and spare parts and for providing complete factory service in the United States on the famous Nassovia Die Sinker have culminated in the appointment of Carl Hirschmann Company, 30 Park Ave., Manhasset, N. Y. as exclusive U. S. representatives of Nassovia Machine works Hanns Fickert, Langen Bei Frankfort a Main (Germany). Nassovia Machines for the manufacture of dies, molds, and other three-dimensional forming tools will be available soon for the inspection and demonstration in the Hirschmann showrooms in Manhasset, Los Angeles and Milwaukee.

In addition to the Nassovia Die Sinker, the Hauser, Schaublin, Tornos, Lambert, Safag, Thommen, Meteor, Lienhard, Technica Swiss Machines will be on display.

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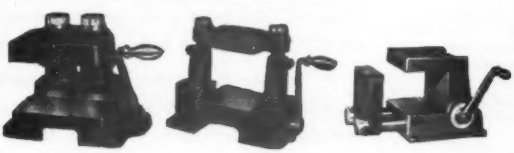

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

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OF YOUR DESIGNERS AND TOOLMAKERS!

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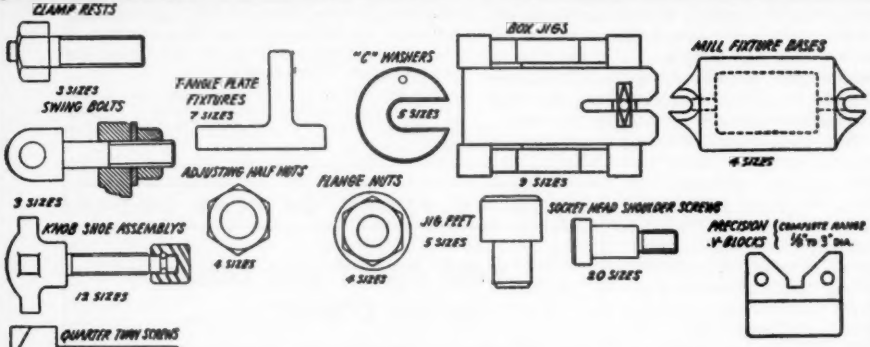

The rush is on . . . manpower shortages are here! Don't waste the valuable time of your designers and toolmakers in custom-building jig and fixture components.

Now is the time to use Noble & Stanton *Standard* Jig and Fixture Parts. Adopt them as standards in your plant. They're the best you can buy—are tough and durable—will never fail on the job—can be used over and over again.

Noble & Stanton Components are precision made from quality steels. NS parts are turned from solid stock—not welded or brazed. They're heat treated and hard chrome plated wherever practicable.

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16	31	46	77	101	125B	139	156	163A	175A	183C	192A	198D	220A	

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16	31	46	77	101	125B	139	156	163A	175A	183C	192A	198D	220A	

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Granite Surface Plates to Five Millionths-Inch Accuracy

The newest method contrived in the surfacing of black granite surface plates to obtain the closest approach to absolute accuracy is the use of an auto-collimator by The Collins Microflat Company. They also announce the development of their largest granite surface plates, measuring 48" x 120".

To produce a surface of such giant area, a means of lapping and checking the surface had to be devised. By adopting the auto-collimator, readings of surface accuracy now can be obtained to within five millionths of an inch.

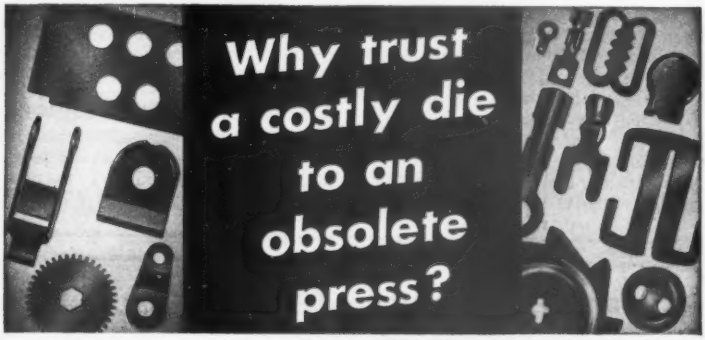
The function of the auto-collimator depends upon the well-known principle that a beam of light reflected by a mirror is deflected if the mirror is tilted; and that the angle through which the reflected beam is turned is twice the angle of tilt of the mirror. A light beam reflected microscopically reveals the most minute inaccuracy, so that the artisan can determine what surfaces to lower, with the end result of scientifically producing a flat area of greatest accuracy throughout the 48" x 120" surface.

. . . Operator Safety, from page 131

May each year. This is strictly one division against the other. It makes real rivalry. This gives a total of twenty-one weeks out of fifty-two where contests are in force. Through this idea we reduce both lost time cases and doctor's orders where no lost time is involved, by 50 per cent.

Sometime ago we started out on one of these "No Accident" campaigns and went through without a single lost time case and decided to continue at the end of the thirteen weeks and went a total of twenty-one months before we experienced an injury that produced lost time. This was accomplished at our Cortland Forging Division where most of our forging operations are located.

In conclusion we feel that if we can start with physically fit employees, indoctrinate them with our safety program, let them know what we expect of them, be sure top management takes care of their responsibilities in providing safe equipment to work with as well as safety protection for the eyes, feet and hands—then produce real enthusiasm among your employees with "No Accident" campaigns—then the net result of this approach should be to "Keep Operators Safe in Forging Operations."



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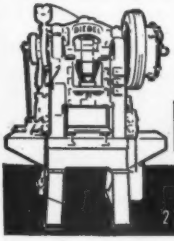

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

It's Your Money! or Here Comes the Swiss Navy

The Chamber of Commerce of the United States, reinforcing its demand for a $5.8 billion cut in the President's $10.8 billion foreign aid spending program for next fiscal year, pointed out that billions of U. S. tax dollars are going into a gigantic waterways system in France, one feature of which is to provide a 354-mile seaway from the Mediterranean to Lake Geneva, 1,230 feet above sea level in the heart of the Swiss Alps.

Russell C. Harrington, chairman of the Chamber's committee on government expenditures, said that "no doubt a Swiss Navy could make a fine contribution to the defense of western Europe," but he pointed out that **the whole waterway program had twice been voted down by the French people when they thought they would have to pay for it themselves.**

The basis of Harrington's information was an article in the March issue of the magazine "Inside Michigan," written by Richard B. Frost, manager of the foreign trade department of the Detroit Board of Commerce, a member of the National Chamber. Frost spent a year gathering material for his article.

Two projects are involved in the French program, one on the Rhone and the other on the Rhine river.

The Rhone project calls for 22 dams and 46 power stations producing 14 billion kilowatt hours of electricity. It includes the Alpine seaway, which is known as the Genissiat portion of the program. The first three of the dams have been completed or are under construction and the cost of these three units alone is $685,000,000, Frost reported.

The Rhine project is smaller, calling for seven dams and nine miles of canals and locks and would produce 6.5 billion kilowatt hours of electric power.

Frost wrote: "The entire cost is an unlimited gift of billions to be paid for by already overburdened U. S. taxpayers."

(Continued on page 162)

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Medelton Motor Driven

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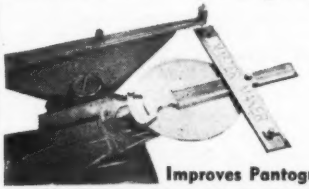

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

"Chip Totes" for Chip Removal

Chip-Totes are unique conveyor units designed for continuously removing chips, turnings and borings from machine tools. The photograph shows an installation at the Erie plant of General Electric Company in which chips are being conveyed from Gisholt automatic lathes. Because the Chip-Totes continuously transport brass chips from the lathes to tote boxes while the machines are in operation, manual scrap handling has been eliminated and the speed of chip disposal substantially increased.

Those in use at General Electric are custom built from stocked components to meet the specific requirements of this particular application. The design is sufficiently flexible to permit modifications according to the type of machine tool, space available, type of metal scrap, and rate of removal.

In this particular installation, chips are funneled onto the Chip-Tote hinged-steel belting, carried horizontally until clear of the lathe's operating mechanism, and then transported parallel to the lathe up the conveyor incline into tote boxes.

When a preset load limit is exceeded, the adjustable safety clutch will disengage, thus stopping the Chip-Tote. It is self contained and uses a special belting featuring interlocking side wing design which prevents chip fall-through. Perforated belts can be used to permit the passage of coolants when required.

Photo Courtesy May-Fran Engineering Co.

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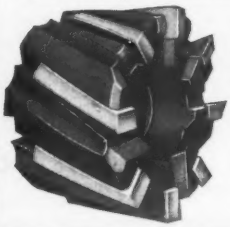
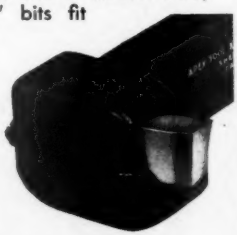


"Apex" inserted-blade milling cutters incorporate the adjustability and economy necessary in these tense times when every ounce of material and every minute of time are vital.



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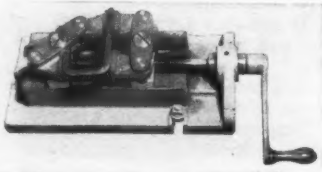

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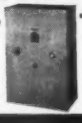

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The Brinnell Company

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

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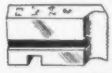

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● This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

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Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
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A New Development In Marform Deep Drawing

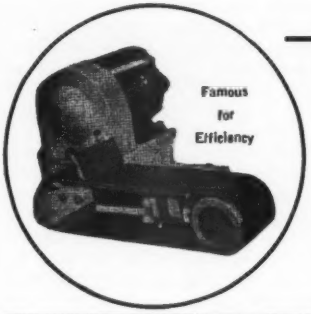
The Marform Deep Drawing Process incorporates the features of the steel die with its accurate forming ability and the rubber pad process with its economy in tooling.

To facilitate the use of this process the Marform Division of the Loewy Construction Company has developed a simplified pressure control mechanism for use with Marform equipment. This mechanism, as shown in the illustration, consists of a flexible strip cam which is readily adjustable by merely turning the friction locking adjustment knobs. The developed profile on the strip cam determines the magnitude of the rubber pad forming pressure as utilized by the process.

In addition to the pressure control, the setting of the three sliding indicators determines the upper and lower limits of the draw depth, as well as the point at which intense forming pressure is built up for setting radii, shearing, etc.

Emergency and manual control buttons are also included on the panel, as well as pressure gauges indicating the system oil and accumulator pressures.

These controls are adjustable in a matter of minutes by merely setting the calibrated rods to predetermined positions. Once such controls are set, the operation is fully automatic and all that is required on the part of the operator is to place a blank in the machine, push a single button, and then remove the drawn part which is automatically stripped from the punch.



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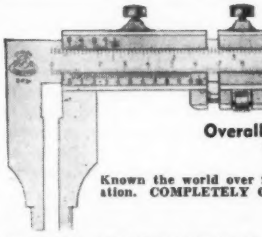

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Your Money, from page 156

Harrington, a Providence, R. I., certified public accountant explained that the money actually comes from "counterpart funds" provided by the foreign aid program.

"Counterpart funds might be described as U. S. dollars which have been forced into French citizenship," Harrington said. "It works this way: The U. S. government takes the money from U. S. taxpayers, buys American products with it, and gives the products to the French government which sells them to private French users. The French users pay the French government francs for the products and the francs form the counterpart fund."

Harrington said the reason that there has been such little information about the French project in this country is that the spending of the counterpart funds is largely left to the French government.

Rep. Meader (R-Mich.) reported on the floor of the House last month that France's counterpart fund amounts to more than $2 billion.

Harrington said: "It needs to be understood that U. S. taxpayers have no claim on the counterpart fund and will never get back a cent of the money they are putting up for the French waterways."

Frost complained that while U. S. tax money was being lavished on French waterways, "our own St. Lawrence waterway and power project goes begging."

"To illustrate what great ambitions can be accomplished outside the United States with American dollars, one of the Rhone locks, when completed, will be the greatest lock in the world, with a height of over 82 feet," Frost wrote. (The whole series of locks would have to raise shipping 1,230 feet to get it from the Mediterranean into Lake Geneva.)

Frost reported: "Little heavy industry is located in the area so opened to navigation. The shipping on the Rhone will be carried in barges and river boats. . . . .

"How many millions of tons of American steel have been diverted to France for use in the project, thereby causing material cutbacks in this country which have helped bring about mass unemployment in many manufacturing areas, is something no one will ever be able to find out."

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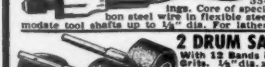

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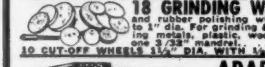

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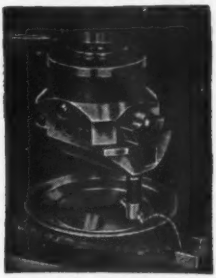

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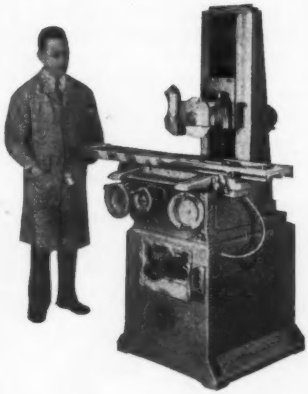

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"Chip Remover" Increases Tool Life

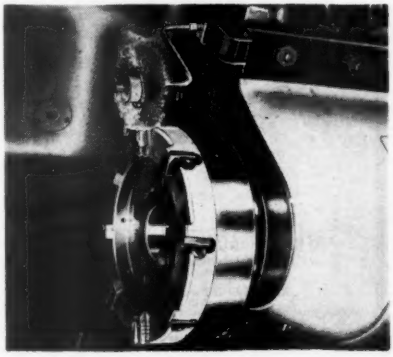
A new device for prolonging tool life on steel milling operations has been added to the milling accessory line of Detroit Milling Cutter Company. This item, called a "Chip Remover", consists of a rotating wire brush attached to a magnetic base, so that it can be easily mounted or dismounted on any horizontal or vertical milling machine. The wire brush is placed in contact with the revolving teeth or blades of the milling cutter and serves to push off adhering chips.

On many steel milling operations, particularly where tungsten carbide blades are used, no matter how speeds and feeds are varied, the steel chips removed cling or adhere to the carbide blades. These chips become work hardened to some extent. Some of the power utilized in milling is dissipated as heat in the discarded chips, causing them to adhere to the cutter teeth and ride around in the cut, fracturing or breaking out the blade cutting edge, consequently shortening the cutter life.

The "Chip Remover" utilizes a 45-50 lb. Alnico, lifetime guaranteed magnetic base with a V slot permitting the mounting of the base on all degrees of cylindrical surfaces, or any right angle surface.

This device provides a positive method for removing welded or ahering chips, and users report up to 100% increase in tool life through its use.

For additional information write DETROIT MILLING CUTTER CO., 28625 Grand River Avenue, Farmington, Michigan, or Circle Inform-A-Gram No. D-1.



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Familiar with all classes of metal stamping production. Excellent opportunity to develop capacity for executive position with a 25 man modern equipped Tool and Die plant in Cincinnati, of long standing excellent reputation. Age preferred between 35 and 40 years. Please reply in full detail. Box 321, Tooling & Production, 1975 Lee Road, Cleveland 18, Ohio.

PLASTICS MOLDS—by Gordon B. Thayer tells how to estimate, design, build and use plastics molds. There are 22 chapters (272 pages) of plastics tooling and production "know-how." More than 200 illustrations, tables and charts. $3.49 per copy. Address Huebner Publications, 1978 Lee Road, Cleveland 18, Ohio.

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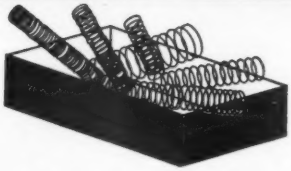
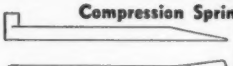


Compression Spring Assortments



Trigger stops for progressive dies. Also gauge stops for dies and fixtures.

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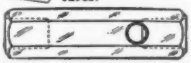

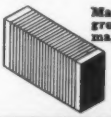

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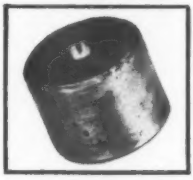

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

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Methods, equipment, and range of application for joining metals by stitching are fully described in Acme Steel catalog, which includes typical job studies.

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Automatic contour milling of long dimension parts — aircraft spar beams, cap strips, etc.—at high speed is subject of Onsrud 6-page bulletin.

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The high production thread rolling of small cold-headed fasteners is achieved by planetary action of Prutton "Rollmaster" offered in Bulletin No. 125.

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GAGE BLOCKS

Gage blocks and accessories for modern measurement control are listed in a coordinated style in the informative new Do-ALL Brochure.

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HYDRAULIC POWER

Catalog 400 lists data on Rivett hydraulic power units available in single pump, double pump and combination types. Capacities from .4 to 48 gpm.

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Continuous removal of chips, borings, turnings, with the May-Fran conveyor is explained in data sheet. Models to fit all standard automatics.

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DRILL GRINDER

Revolutionary twist drill grinder gives uniform lips, longer drill life, more accurate holes, reduced drilling time. Kurt Orban data sheet available.

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ETCHING

Lectroetch folder describes stencil etching process by which practically any material, including carbide, is effectively marked without deformation.

Circle No. E12.

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Procunier tapping head ensures accurate sensitive tapping on most drill presses. Bulletin cites long tap life, on production work.
Circle No. E17.

FINISHING
Hammond catalog No. 75 lists many abrasive belt and wheel finishing machines, belt backstands, and dust handling equipment. Illustrates many uses of units.
Circle No. E18.

FLOATING HOLDERS
Heat treated, ground floating tool holders, used to center rotary cutting tools on hand and automatic screw machines, described in Podlin catalog sheet.
Circle No. E13.

MOTOR STARTERS
Multi-speed and reversing motor starters, featuring positive interlock, small size and light weight, are offered in new Arrow-Hart 8-page bulletin.
Circle No. E14.

MALLEABLE CASTINGS
The heavier weights of malleable castings are the subject of an attractive Belle City folder. Production procedures are shown.
Circle No. E21.

ABRASIVE CUTTING
A color-coated chart giving recommendations for the selection of abrasive wheels is a feature of Allison's new, comprehensive catalog.
Circle No. E22.

HI-LIFT TRUCKS
Barrett-Cravens bulletin illustrates line of "walkie" units designed for local transfer, lifting, and stacking of heavy loads at heights up to 121".
Circle No. E15.

AUTOMATIC STRIP GAGING
Automatic continuous, accurate control of thickness and width in strip rolling, with magnetic gages, is explained in informative Pratt & Whitney brochure.
Circle No. E16.

VERSATILE MILLING MACHINE
Versatile Model 40 milling machine, described in Index bulletin, offers precision at low cost. Improved spindle permits boring, gives 9 speeds.
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INTERNAL GAGING
Size Control bulletin offers Tesa internal bore and screw-thread micrometers, for fast accurate inspection from .275" to 8" dia. Readable to .0001".
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MEASURING
New 80-page Catalog GEC-1016 summarizes for the first time under one cover all G-E measuring equipment for laboratory and production line use.
Circle No. E19.

HANDLING
Using a unique system of visual cross reference charts, a condensed Clark equipment catalog makes all essential truck model data available at a glance.
Circle No. E20.

. . . Standards, from page 84

we had no previous information as to which specifications were actually too rigid, or to what extent they could be relaxed without impairing quality. We had to find out the hard way.

To meet this problem, there was set up a Quality Review Board at the plant, consisting of an Air Force representative, the Chief Inspector, and a Quality Engineer. When a part came through that regular inspection showed to be slightly off on perhaps one of its fifty specifications, it went through another inspection by this Board. If they found the part's functionalism, interchangeability, and other pertinent characteristics were not impaired, they accepted it and passed it on for release to assembly.

Every precaution was taken by this Quality Review Board to see to it that only needless specifications were relaxed to conform to the realities of the part's function and the manufacturing problem involved. Specifications that were open to question in this light were carefully studied, deviations were endurance tested, and where found practical and approved by the Air Force, deviation drawings were made up for the guidance of the Quality Review Board.

In a low-volume operation, it may be a perfectly good policy to insist upon extremely close engineering beyond actual needs, as a means of training precision craftsmen and instilling precision-mindedness for jobs when close precision is a vital factor. But when you move into high volume output, you must beware that you do not fall victim to this over-engineering, for you can engineer yourself right out of production.

We are quite proud of our engineering and manufacturing ability in the automobile industry. I think that the industry's record in the last war leaves no doubt in anyone's mind about its ability to turn out, in volume, work of the closest precision where it is needed. At Chrysler Corporation we made huge quantities of anti-aircraft guns with the most intricate mechanisms imaginable. At our Dodge main plant we made thousands of intricate, delicate gyro-compasses for the Navy, a job originally thought impossible for anyone but a manufacturer especially trained in the art.

I single out these two instances from our many World War II projects to emphasize that we do not shy away from work of the closest precision, even when it is required in vast quantities in a hurry.

But what I do urge is that the highly skilled workers and the valuable close precision tools be used where they can do the most good, on those jobs where the most rigid adherence to exacting standards is a vital necessity. There must be common sense to your standards so that the vital standards are not impaired by dissipating your best talents and equipment over unnecessary operations.

At that, however, we at Dodge-Chicago were better off I am sure than many other manufacturers running up against the same problem in other military items. At least we had established a procedure whereby the deviations from standard, where they did not affect the part's performance, could be processed, thus saving material and man-hours that might otherwise have been wasted.

As an interim measure to keep things running smoothly while such standards are being corrected at the source, it would be extremely helpful to have a common established procedure for passing on these deviations from standard at all the manufacturing plants.

This is only one of the problems we must continually cope with to utilize fully the men, machines, intelligence and experience in the factory and on the battlefronts for the defense of our nation.

As I said earlier, it is a constant, never-ending job. During World War II industry accomplished much in the way of understanding the problems facing the Armed Forces and in contributing solutions. The Armed Forces demonstrated their willingness and ability to understand industry's problems. Since that time, both have attempted to continue the partnership and close cooperation of industry and the military that worked to such devastating effectiveness during the war. If we are to maintain a proper state of preparedness, we must never let up this effort. For our very security must rest on this teamwork of our industrial and military establishments, on a man-to-man trust and respect for each other's abilities, and a clear understanding of the other's point of view.

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$58.00 for the first 100 pieces
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FREE DATA on this outstanding new drill press will be sent upon request. Ask for Bulletin TP-4.

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

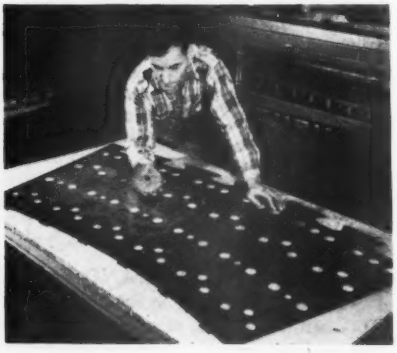
. . . Quality Control, from page 60

the operator has the proper tools, information, comprehension of the job and gages to insure production of parts that will meet manufacturing specifications. Duplicate gages are available—one is used by the operator, the inspector keeps his as a master. The inspector examines enough pieces to assure himself of a representative sample and, in addition to the usual inspection for conformance to specifications, the inspector checks to determine that: (1) general working conditions are satisfactory from the standpoint of safety, fatigue and general welfare of the operator; (2) the work area is clean and orderly; (3) tools used by the operator are properly adjusted and lubricated; (4) the operator has the right material—proper gauge size, proper hardness; (5) the parts don't show excessive burr; (6) the operator shows a complete understanding of the job; (7) the operator has gages or other means of checking the job quickly and accurately.

If the first place inspection shows that the quality of the parts are satisfactory, the inspector signs the operator's pay card authorizing him to proceed with production.

Each operation in an assigned area is patrolled by the inspector at regular intervals. In addition to the items mentioned above, he checks for tool wear and handling facilities employed. His frequency of patrolling is determined by such factors as operator skill, closeness of tolerances and rate of tool wear.

Fig. 3. No matter what the size of the punching, the same tolerance of workmanship is required.



Simple control charts are run on jobs calling for close dimensional control or on jobs showing rapid tool wear. This keeps the inspector, foreman and the operator alert to the danger of exceeding specifications at all times. The inspection of the last piece of the order is left to the judgment of the inspector. If, in his opinion, the tools require dressing, he has them sent to the tool room for repair. It is this maintenance that eliminates many of the minor defects of daily production.

As parts are completed, they are forwarded to the shipping area where all shipments are subjected to a sequential sampling plan. All lots failing to meet the requirements of the drawing and specified as critical on the sequential sampling cards are rejected and returned for rework.

The sequential sampling plan can be used successfully for the inspection of metal stamping parts. The results of the sampling are recorded on a special sampling form and the outgoing quality level is determined each week and charted. The charts and substantiating details are reviewed each week with the responsible foreman who, in turn, takes the necessary action to correct and improve the quality of the parts.

Armature Punching Section

Laminated punchings from electrical sheet steel are the specialty of the metal stamping department. Here, the sizes can range from diameters of two inches for miniature motors to segmental laminations for 100,000 KVA generators having bore diameters in excess of 300 inches.

To tool for activity of this proportion, press capacities range from 3 tons to as high as 2000 tons. Operational sequence limitations are determined, to a large extent, by the activity. In general, the universal simple tool method is used for low activity jobs; the Continental tool method is used for medium active work requiring close and controlled accuracy, and the standard tool method is utilized for highly active jobs having close dimensional tolerances.

The importance of the proper tool design or the dimensional control required on dies cannot be overemphasized. This, fundamentally, is where the quality of

(Continued on page 174)

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The new, amazing magnetic base holder for mounting Test Indicators to flat or curved surfaces INSTANTLY!

NO MORE CUMBERSOME HAPHAZARD CLAMPING

Ball and socket swivel construction permits precision adjustment.

Fingertip control for operating magnetic release.

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Complete accessories included for taking all indicators up to 3" dia.

Magnetic pull, approx. 100 lbs. Size of base, 1¾" x 4".

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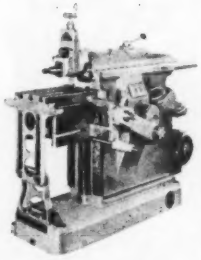

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Cutting Speed Indicator

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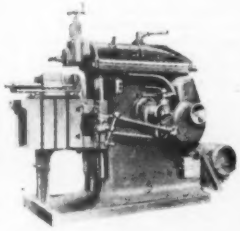
V Belt Motor Dr.



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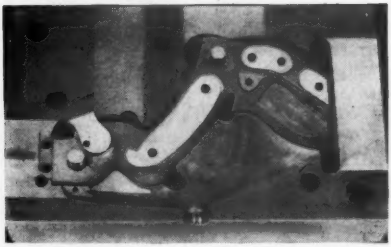
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Die Duplicating, from page 71



A coin-chute die as seen in process of duplication by machine pictured on page 71.

tracer point is maintained as a constant, through the action of these electrical contacts. This constant pressure is very light, being measured in ounces, and is completely independent of the size of the job being handled or the depth of a cut being made. On these machines, a bracket is provided above the cutter on which the tracer is installed. The distance between tracer and cutter can be adjusted to suit the particular size of work being handled.

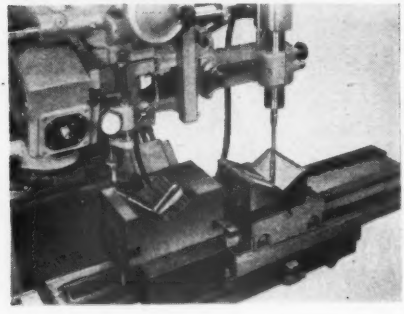
Electrical Control Guides Cutter Precisely

From the time the work starts, tracer and cutter move through paths precisely alike, the tracer following the shape of the model and the cutter duplicating that shape in the workpiece. Reproduction is highly accurate. Because the electrical control is accurate and delicate, the very finest detail can be produced on even the very largest of dies or molds. Practically any type of job can be handled on a machine of this kind, whether it is a simple profiling job or a piece of die-sinking work of the most complex kind.

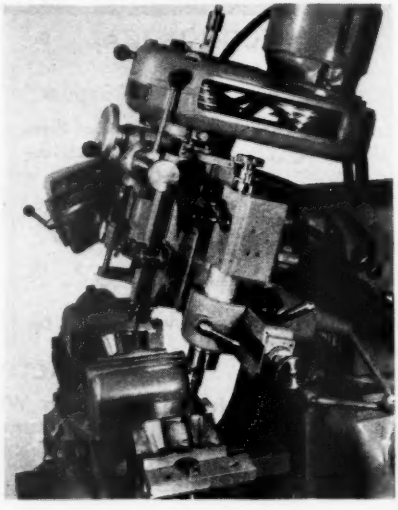
Generally, a machine of this kind is equipped with a profile tracer, which is employed where the cutter is to have movement through two dimensions only, and with an automatic tracer which is used for three-dimensional work, whether cavities or external forms are involved. There is also a combination tracer which can be used with the machine to combine the functions of an automatic tracer and a profile tracer. However, this combination tracer has certain limitations. It cannot be

(Continued on page 182)

The Cincinnati tool and die miller shown here has a hydraulic-tracer mechanism, providing for highly accurate duplication of master shapes or templates. This is accomplished without need for special skill on the part of the operator. The mechanism consists of a completely hydraulic automatic tracer, which synchronizes the vertical movements of the spindle with the table or saddle movements, to simplify production of dies or other complex shapes. The tracer mechanism is carried on three sliding elements to provide longitudinal, transverse and vertical adjustments of the tracer finger relative to the cutter. The machine also accommodates a so-called reverse image attachment, which is seen in use.



This Cincinnati tool and die milling machine has a head which can be swiveled to facilitate duplicating operations. The swivel mounts are of unique design, consisting of segmental circular ways, permitting the entire spindle-carrier unit to be swiveled about a pivot point located approximately at the tip of the cutter. The head is here seen swiveled to the rear, permitting the cutter and tracer to get down into sharp bottom corners.



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Precision processed of finest high speed tool steel, and scientifically heat treated for long cutting life . . . *Reltool End Mills are famous for long cutting life. Available* in single- and double-end types, in small and large diameters, with 2, 3, and 4 flutes, with straight or ball ends, in over *1000 stock sizes.*

• RELTOOL END MILL HOLDERS are made in both Tang and Draw Bar Style, and with Morse or Brown & Sharpe Taper. Sizes over ¾" have Dual Set Screw. For complete list of sizes and prices see Reltool Catalog No. 50 and latest Discount Sheet.

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Yes, the OLIVER Method for machine sawing, filing and lapping operations has proved itself for almost four decades. Thousands of plants have increased their toolroom efficiency with OLIVER Die Makers while effecting savings up to 60%. They are noted for their speed, accuracy and long lasting qualities (in fact, many OLIVER Die Makers have been in continuous use for more than 25 years). Best of all, they are so simple to operate that skilled labor is not required—helping to eliminate the bottlenecks caused by hard-to-get trained manpower.

OLIVER DIE MAKERS
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The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.

The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Quality Control, from page 170

the final product is obtained, but is a phase of the discussion best left to the tool engineers. However, if this phase of operation were not based on the highest plane of engineering and workmanship, and if there were no proper raw materials inspection, the present inspection procedure would have to be completely revised.

The control of the punching operation in the armature punching section is basically the same as discussed in the miscellaneous punching department. The only difference is that the first piece and patrol inspections are more complicated, because they now include many of the following: (1) out-of-roundness of bore diameters; (2) flatness; (3) degree of index; (4) thickness of sodium silicate insulation; (5) thickness of burrs; (6) warpage of teeth in punching; (7) conformance to drawing dimensions.

Applied Engineering in Quality Control

Several interesting fixtures developed by the tool engineers, have assisted in maintaining the quality level. As shown in Figure 1, a special stacking fixture was developed to align the slots of the laminated punchings and to reduce damage to parts in the material handling phase. This tool enables the patrol inspectors to determine any change in the original setup due to wear or mechanical shift. In the assembly of rotors, any misalignment could result in a fractured winding insulation and a motor failure on final test.

Fig. 4. A 20-foot high, 250-ton inclined punch press. The foundation for this machine is as deep as it is high.

Fig. 5. Special pneumatic grasp and stacking arm attached to inclined press catches laminations and stacks them in special container on dog-eared pallet.

Even with proper die maintenance a slight burr condition will remain, so a roll-burr grinding operation has been incorporated in the final sodium silicate insulating operation (Figure 2). These are but two samples of the many applications emphasizing the end result of applied engineering in a controlled quality product.

To obtain these results, production invariably follows a definite pattern: process analysis, statistical analysis to determine the extent of variability, design of equipment and processes to eliminate the variances, and the final application of a systematic inspection program based on a mathematically designed sampling plan to insure adherence to a prescribed quality level.

CERTIFICATES OF MANAGEMENT EXCELLENCE for the year 1951 have been awarded to seven companies in the machine tool field by the American Institute of Management, New York, a non-profit organization devoted to the study and improvement of corporate organization and management. The companies are: Cincinnati Milling Machine Co.; Ex-Cell-O Corp.; Greenfield Tap & Die Corp.; Marlin-Rockwell Corp.; Monarch Machine Tool Co.; Timken Roller Bearing Co., and Union Twist Drill Co. This is the second time these companies have been cited by the Institute.

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MANUFACTURERS ENGINEERING SERVICE, INC.
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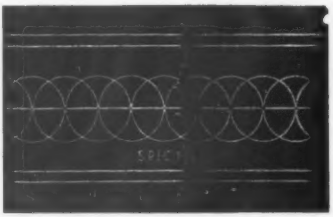

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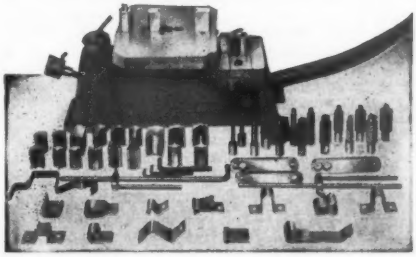
CUTS, BENDS, PUNCHES - WITHOUT SPECIAL TOOLING



Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend and cut round or flat brass, bronze, aluminum, steel, etc., up to 3/16" x 1½" as illustrated, other models up to ¼" x 4".

Write for descriptive literature.

J. A. RICHARDS CO.

NORTH PITCHER ST. KALAMAZOO, MICHIGAN

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. . . Copper Alloys, from page 148

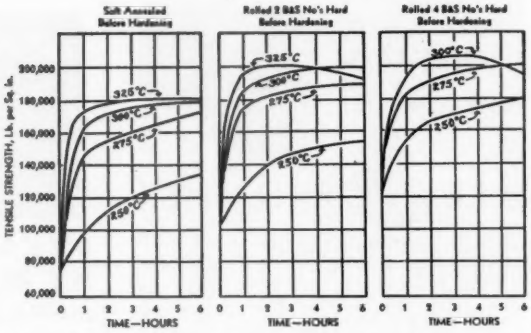


Fig. 6. Increase of tensile strength at various aging temperatures and the effect of prior condition of sheet.

Tale II (below)

The physical properties of rod, sheet, strip, and wire, after precipitation heat treatment.

Courtesy American Brass Co.

cold worked condition of the strip is illustrated in Figure 6. The physical properties of rod, sheet, strip and wire after precipitation heat treatment is given in Table II.

In final hardening, care should be taken to support the work properly so as to avoid distortion. If the parts are perfectly flat, they can be piled one on another and clamped in a jig consisting of two heavy flat pieces. Such designs as diaphragms, cups and similar parts require clamping in a jig consisting of two members which conforms to the shape of the parts. Fixtures can be made from

(Continued on page 184)

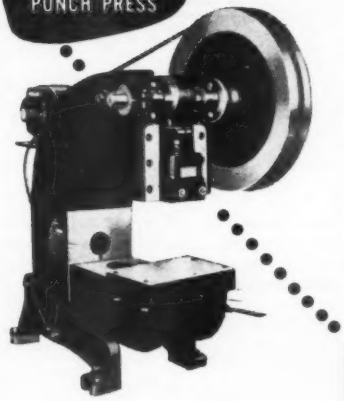
Table II. Physical Properties of Beryllium Copper—Material Commercially Available and Properties to be expected after Precipitation Hardening. (A.S.T.M. Specs. B120-41T)

	Diameter or Thickness, Inches	Tensile Strength, psi	Yield Strength psi	Elongation, % in 2 in.	Rockwell Hardness 'B'	Rockwell Hardness '30T'
Rods and Bars, Commercially Available						
Annealed	⅜ to ¾	80,000M		35.0	80M	68M
	over ¾	80,000M		35.0	80M	68M
Hard	⅜ to ¾	95,000m		5.0	90m	74m
	over ¾	80,000m		5.0	90m	68m
Rods and Bars, Precipitation Hardened						
Annealed and Precipitation Hardened	all sizes	150,000m	85,000	3.0	33m	53m
Hard Temper and Precipitation Hardened	all sizes	175,000m	88,000	2.0	38m	57m
Cold Rolled Sheet and Strip, Commercially Available						
Annealed		80,000M		35.0	80M	68M
Quarter-Hard, B&S No. 1		73,000m		10.0	72m	62m
Half-Hard, B&S No. 2		80,000m		5.0	82m	69m
Hard, B&S Nos. 4		95,000m		2.0	93m	77m
Cold Rolled Sheet and Strip, Precipitation Hardened						
Annealed and Precipitation Hardened		150,000m	90,000	5.0	33m	53m
¼ Hard and Precipitation Hardened		160,000m	92,000	3.5	35m	55m
½ Hard and Precipitation Hardened		170,000m	93,000	2.0	37m	57m
Hard and Precipitation Hardened		180,000m	95,000	1.0	39m	59m
Wire, Commercially Available						
Annealed		80,000M		35.0		
Quarter-Hard		90,000m		5.0		
Half-Hard		100,000m		2.0		
Wire, Precipitation Hardened						
Annealed and Precipitation Hardened		150,000m		1.5		
¼ Hard and Precipitation Hardened		165,000m		1.0		
½ Hard and Precipitation Hardened		180,000m		0.5		

*At 0.5% elongation under load

m = minimum
M = maximum

KENCO
5-TON
VARI-SPEED
PUNCH PRESS



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SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

The Cause and Cure of Pulsation in Centrifugal Blowers

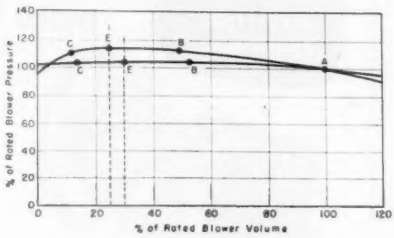
When a centrifugal blower is used in the capacity range for which it was designed, pulsation is seldom a problem. There are, however, certain applications of blowers where it is necessary to keep the blower running during periods of very small demand. In the case of certain heating processes these "turn-down" or "week-end holding" periods may call for as little as 10 or 20 per cent of rated volume output of the blower. In such cases, surging can set up a pulsation which may disturb the process and cause overheating and consequent damage.

Such pulsation can be prevented—and corrected—if one understands the mechanics of pulsation and the characteristics of a centrifugal blower, as here interpreted by O. W. Acheson, Billmyre Blower Division, Lamson Corporation, Syracuse.

The pressure-vs-delivery curves shown in the accompanying sketch are typical of all centrifugal blowers, the upper curve being of a well-designed blower, and the lower curve of a "not-so-well" designed blower. Note that in both cases the pressure attains a maximum high point at some relatively low rate of air output, the curve rising at air delivery rates below this critical value and descending at rates above this critical value.

If the demand on a blower is decreased in volume from a normal operating point, A, to another normal operating point, B, above the maximum-pressure point, the pressure at the blower merely rises correspondingly, and pulsation does not occur. If, however, the load or volume requirement is decreased beyond the maximum-pressure point, E, to a very low point, such as C, the following sequence of circumstances may set up surging.

The blower delivery pressure first decreases from E to C *at the blower itself.* Thus for a moment, the pressure in the piping system connected to the blower is greater than the pressure at the blower itself. Thus the air in the line tends to reverse its direction and flow back into the blower (this can be extremely dangerous in handling gas to a burner or combustion chamber) until both pressures become equalized. When this is achieved the blower again resumes its normal function of pumping air into the system—until the restriction at the line outlet again reduces throughout and causes the sequence to repeat.



It is this repetition which constitutes surging.

The frequency and intensity of surging depends upon: (1) the slope of the pressure-vs-volume curve, (2) the rate at which air is being removed from the system, and (3) the volume of the pipe system to which the blower is delivering air. The same principles apply whether the centrifugal unit is operating as a blower or an exhauster.

The wisest action to take in the prevention of pulsation is the anticipation of circumstances which might cause it. The phenomenon will not occur in volumes above the point E. If the application is such that low turn-downs are expected, it is prudent to so indicate when the blower is being ordered. The blower manufacturer can, in most cases, select and specify to prevent pulsation.

If, however, pulsation or surging is noticed in a finished installation, any of the following five steps can be taken:

(1) Consider the economies of replacing the blower with a smaller capacity unit having a consequently lower surge point.

(2) Consider purchasing a small capacity unit for turn-down periods.

(3) Make sure that the amount of air delivered by the blower is always above the surge point by bleeding enough air out of the system beyond the blower. If you are handling gas rather than air, it

(Continued on page 181)

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HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
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Set G-501

When you want the finest in hand-cut, ground or carbide cutters, specify Haskins. They give you many advantages over ordinary files—faster cutting, longer tool life and fewer resharpenings—advantages that mean reduced costs, reduced labor and lower over-all tool costs.

Pictured above, set G-501, available also in hand-cut set H-501. For additional shapes, send for complete catalog—R. G. Haskins Co., 605 S. Washtenaw Ave., Chicago 12, Ill.

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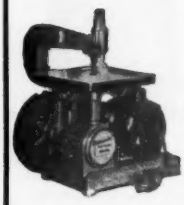

DIE FILER
Model FS shown performs all die making operations. Equipment includes File Roller Support Overarm in addition to overarm shown.

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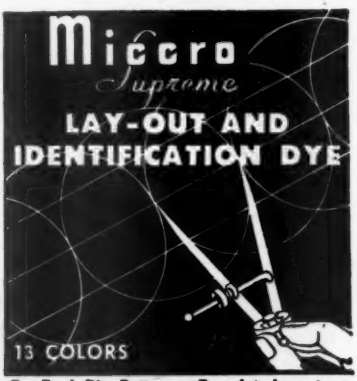

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PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

. . . Pulsation, from page 178

will be necessary to recirculate this bleed flow back into the blower inlet. If you recirculate the bleed, however, remember that you are compressing and re-compressing that portion of the gas and building up the blower temperature to a point which may be detrimental.

(4) If the surging is infrequent and of short duration, it may not be harmful to the blower at all. Surging at the point of air or gas use may be eliminated by adding a surge tank or increasing the cubical content of the piping in front of the nozzle.

(5) Ask the manufacturer to make minor changes in the blower design to permit by-passing of the air, or take other steps which will eliminate the troublesome pulsation at the sacrifice of a little blower efficiency or tightness of the installation.

Actually, the more efficiently a blower operates and the tighter the air system is beyond the blower, the more likely it is to surge at very low operating points. Fortunately, the uses for compressed air or gas, which demand blower operation at critically low output, are infrequent so that the use of high-efficiency equipment can be made in all but the rarest of cases.

★ ★ ★

Metal Fire Extinguisher

A new pressurized extinguisher designed to smother hazardous fires in metals, has been developed by the Ansul Chemical Company.

Expelling a new dry powder known as Met-L-X, the extinguisher has been tested and found highly effective against fires in magnesium, sodium, potassium, zinc, powdered aluminum and other metals.

Because of its importance to the war effort, the extinguisher has been placed by the government on Defense Order allocation and will not be available to the general public for some time.

The MET-L-X powder extinguishes metal fires by forming an air-excluding crust over the burning metal as it contacts the flames. With oxygen excluded, the fire is extinguished.

The powder is moisture-repellent, free-flowing, non-toxic, non-corrosive and non-abrasive. It does not conduct electricty and will not deteriorate under normal conditions.

SINGLE-ACTING Air-Clamp*

Bore	STROKES Horizontal	Vertical
1"	5/8"	1"-2"
2 1/4"	1"-2"-3"	5/8"
3"		1/2"-2"
4"	2"-2 1/2"	3"
5"	3"	3"
6"	3"	2"

* Pneumatic Cylinders

NEW CATALOG READY! Complete line of simple, adaptable, compact spring-return air cylinders. Cut costs and speed up production the modern, Air Power way. Write today.

MEAD SPECIALTIES COMPANY

4114 No. Knox Ave., Dept. HA-42, Chicago 41, Ill.

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

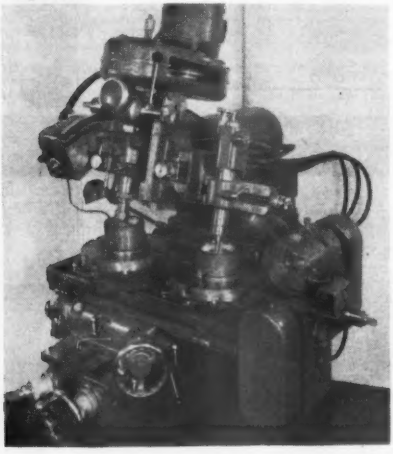
. . . Die Duplicating, from page 172

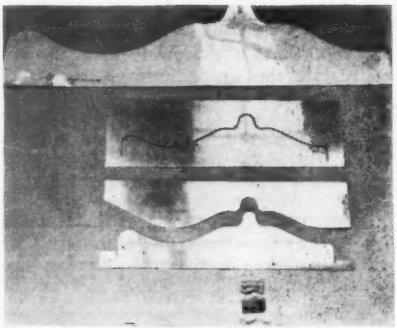
used on work having a cross-section with rises and falls of more than 45 degrees.

Cases in which dies of a particular type are needed in very large quantities are relatively rare, yet they are encountered. In such instances, it has been found that much time and labor can be saved through use of machines of the general type mentioned which employ a gang of cutter spindles, one above the other. Thus, three-spindle machines of the general type mentioned have been provided in different instances.

A case in point is production of small forging dies for the mass production of plier halves, where three dies are reproduced at each setup from a single steel master. More recently, a four-spindle duplicating machine of this type has been developed, and is now in extensive use for making forging dies for jet-engine blades, four at a time.

A duplex rotary table attachment can be applied to the Cincinnati tool and die miller, as is shown here. It converts the machine into an automatic die sinker, capable of accurate duplication of complex shapes and intricate detail without more than casual attention from an operator. The pair of circular tables seen are rotated in unison. A chain drive from the power unit to the saddle cross feed screw provides a continuous though slow cross feed movement to both rotating tables. This movement provides a continuous pick-fed increment for each revolution of the tables. Therefore, both cutter and tracer are automatically traversed across the work and the master as they rotate, until the entire job has been completed.





These small male and female forming dies, used for production of irregularly-shaped springs, are reproduced from highly-oversized masters by the pantographic machine method. The process allows both the male and the female die to be produced at the same operation, and to augment accuracy the original celluloid master was made 20 times oversize. This large celluloid pattern was then placed on a Gorton pantographic machine, set for 2 to 1 reduction. From it, an aluminum master was cut. As first cut, this aluminum master is seen directly below the large celluloid master. Note that both the male and the female model are left in one piece here. The diameter of the cutter used to produce this aluminum master correspond to the thickness of the steel spring stock to be worked (.012"), times the "oversize" used in reducing. This aluminum master is ten times oversize. Therefore, the cutter diameter is .012" times ten, or .120". When the ends in the master are cut through, they cannot fail to match precisely, and consequently to make a perfect pair of male and female dies. The finished dies, together with a segment of the piston-ring expansion spring they are designed to form, are seen below.

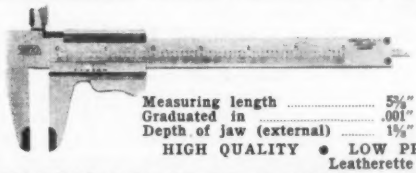
Pantographic Engravers as Duplicators

Many do not realize how highly important the pantograph engraving machine is in the field of die and mold duplication. It is, of course, particularly adaptable for reproduction of dies and molds where relatively light cuts are involved. In respect to accuracy on such cuts, some of these machines, if making multiple dies from a preliminarily prepared master made oversize, are *extremely* accurate. If and when an original pattern is made two or three times oversize, respectively, and a pantograph ratio is employed with a reduction of 1 to 2 or 1 to 3, respectively, any faults or errors in the pattern will be reduced to one-half or one-third, ignoring any slight deviations that may be accountable to the duplicating operation itself.

Machines of this type are, in fact, much

(Continued on page 186)

PRECISION VERNIER CALIPERS



The TUNA Precision Vernier Calipers are made of best Swedish steel with hardened measuring surfaces.

Measuring length	5⅞"	Depth of jaw (internal)	⅝"
Graduated in	.001"	Depth of measurement from	0 to 5⅜"
Depth of jaw (external)	1⅝"	Net weight	5 ounces

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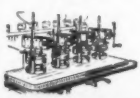

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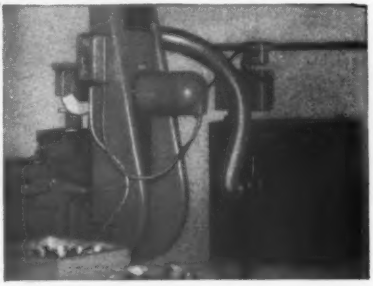

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. . . Copper Alloys, from page 176

cold rolled steel, and it is imperative that the engaging or clamping surfaces of the fixture be dimensionally accurate since they will determine the size and the shape of the finished part. Also, where a gang assembly with jigs is used, the use of either a salt bath or a convection type furnace is preferred. A still dry atmosphere can be used, but this increases the heating time considerably.

Where parts cannot be supported by jigs and fixtures due to the design, it is recommended that the parts be made from previously cold worked material of a hardness consistent with the ability to form the part satisfactorily. This greater stiffness will assist in keeping distortion under heat treatment to a minimum.

Although the copper-beryllium composition is the most widely used alloy within the "precipitation hardening" class, there are other binary and ternary alloys which also react similarly.

The chromium bronzes can be solution treated by water quenching from 1800 deg. Fahr. followed by a precipitation treatment at 900 deg. Fahr. for a suitable time period.

The physical properties of the aluminum bronzes where the aluminum content is over 10 percent can be improved by water quenching from 1500 to 1600 deg. Fahr., depending upon the cross section, followed by an aging treatment from 700 to 1000 deg. Fahr.

Other precipitation hardening alloys or the silicon bronzes containing 4.0 percent silicon and 1.0 percent manganese; the nickel-aluminum bronzes with K-Monel being a member of the group; the cast bronzes containing from 5 to 8 percent tin and 1.5 to 8 percent nickel where the higher nickel alloys can be precipitation hardened; and the tin bronzes containing more than 15 percent tin.

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5. Materials and Methods Magazine:
   a. "Bright Annealing of Nickel Silver Accomplished on a Production Basis", J. W. Carter, Dec. 1949.
   b. "Engineering Bronzes", K. Rose, April 1946.
6. "The Working of Wrought Bronzes", American Machinist, Aug. 23, 1939.
7. "Bridgeport Brass Technical Handbook", Bridgeport Brass Co., Bridgeport, Ct., 1950 ed.
8. "The Metallurgy of Deep Drawing and Pressing", J. D. Jevons, 1942 ed., John Wiley & Sons, N. Y.
9. "Cold Working of Brass", L. E. Gibbs, American Society for Metals, 1946 ed.
10. "Atmospheres and Controlled Atmosphere Furnaces for Non Ferrous Metals", W. Lehrer, Metal Progress, March 1948.

★ ★ ★ ★ ★ ★

SECRET WEAPON? Not so you can notice it! Actually it is an unusual angle view of a Gisholt No. 24 Hydraulic Automatic Lathe used for machining diesel cylinder liners. The "gun" is nothing more than a cylinder liner on the swivel-base arbor. While one liner is being machined, the finished piece is unloaded and replaced with a new liner.

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Longer Life Between Grinds!
for.. .... Die Sinkers
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All standard COLONIAL drill jig bushings are now made from Colonial #3—a new oil-hardening steel having many times the wear-resistance of former bushing steels. Also gives greater uniformity.
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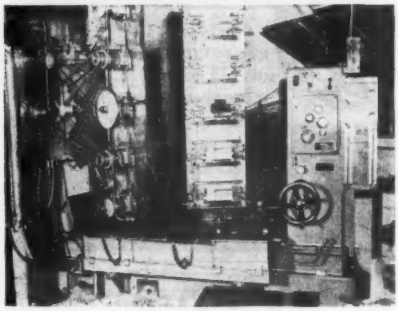
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

. . . Die Duplicating, from page 182

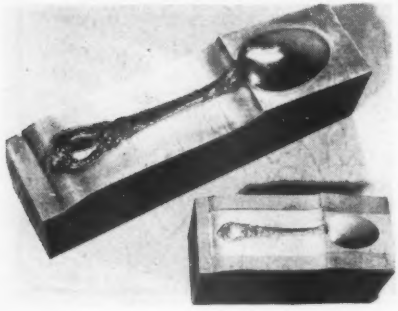


A four-spindle Pratt & Whitney, Keller duplicating unit with a competent system of electrical control. This machine has been recently developed and is being extensively used for making forging dies for jet-engine blades, four at a time. Three-spindle machines are also available.

employed for making die hobs, as discussed earlier in this article, provided those hobs are within the capacity of the pantographic engraving machine. The smallest models of pantographic engravers are available in pantograph ratios anywhere from 1 to 1 all the way down to 1 to 100. A larger machine is available in the (1 to 1) to (1 to 16) range.

It should be remembered that both two-dimensional and three-dimensional pantographic engraving machines are available,

A table-ware spoon die of elaborate design. All of the intricate design shown was developed on a Gorton three-dimensional pantograph machine from a two-times-enlarged master. Only six hours were required for the job, as against 40 hours of hand engraving by earlier methods. Silverware designs are only one of the many examples of fine and intricate work reproduced regularly on pantographic machines, with results that will equal the best hand-engraving methods.

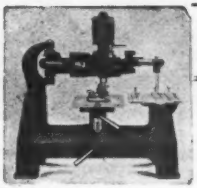


An example of drawing dies for producing complicated shapes. Extremely high accuracy in such work is possible, because pantographic reduction from the master to the job may be as high as 100 to 1. The dies are a part of a series of eight, used in forming bronze strips which dovetail together for the cables for the Boulder Dam transmission lines. Note how ten segments fit together to complete an exterior sheath for the cable. Die blanks of cobalt or chrome vanadium steel are forged, machined and annealed, leaving .070" of metal for removal by the Gorton pantograph machine. The master template in this case was enlarged ten times. The cutter was of .035" diameter, and turned 3000 revolutions, cutting three to five thousandths in depth at each pass. Approximately 80 minutes is required to do the pantograph job complete. The finish is clean, sharp and practically void of tool marks.

and that where one desires a machine for mold or die duplication, a three-dimensional unit should be employed. Many of these machines are particularly sensitive and accurate, and admirably meet the requirement of tool men who must produce small intricate dies, molds or hobs for use in the jewelry, plastic, die casting and allied fields.

It is highly obvious that practically all machines described for use in die and mold duplication, being versatile as they are, are also fully adaptable for complex production operations on many types of production parts. Their consideration in this particular respect falls outside the scope of the present article, but manufacturers possessing such machines often find it expedient to use them on various difficult and complex operations other than mold, die or hob duplication.

MORTON MACHINE WORKS, Ferndale, Michigan, in keeping with its expansion program, has appointed Howard C. Carlson, formerly general manager of Ramsey Electric Company, as general office manager.



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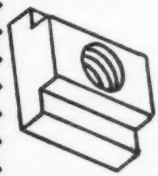

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Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle.

It is an established fact that surface speeds must stay up to approximately a mile a minute if you want to grind—not just rub. Every mechanic knows this, but inexperienced buyer may order tools that maintain proper grinding speeds only when running idle. The speed of Kipp air grinders drops but slightly when put to work. That means better work—longer wheel life.

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PROGRESS

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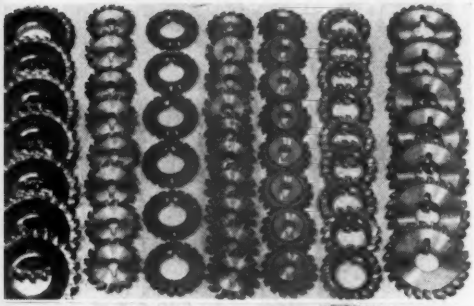
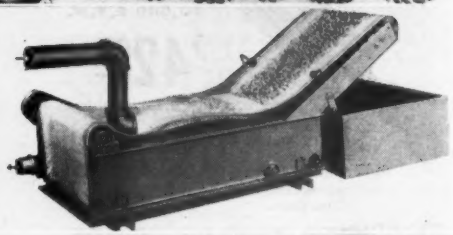
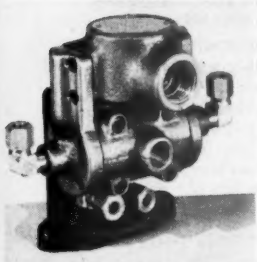


Special Carbide-Tipped Cutters for milling the airfoil form of stainless steel for jet compressor blades have been developed by Ex-Cell-O. Designed to stand up under heavy cuts in this tough material, these Continental cutters are equipped with the grade of carbide that has proved best in long production runs. Write EX-CELL-O CORP., 1200 Oakman Blvd., Detroit 32, Mich., for details.
Circle Inform-A-Gram No. A1.



The Automatic Houdaille Web Type Filter features a self-cleaning, continuously rotating filter web. Use of the complete filter bed enables this small, compact filter to handle a large volume of coolant. Endless web-type belt utilizes the same filtering medium over and over;. lasts for long periods of operation. This unit is suited to any machine tool or small central coolant system where a mineral or soluble oil coolant is used. HONAN-CRANE CORP., 208 Indianapolis Ave., Lebanon, Pa., will provide detailed literature.
Circle Inform-A-Gram No. A2.



The Bellows EXV Electroaire Valve (outside cut) is a complete "packaged," explosion-proof, low voltage electrically-controlled air powered air valve. Built into one integral unit is a four-way direction slide valve, solenoid control units and piston rod speed regulators. The valve fully meets the established standards for wiring in hazardous locations. Address THE BELLOWS CO., Box 631, Akron, Ohio, for information.
Circle Inform-A-Gram No. A3.

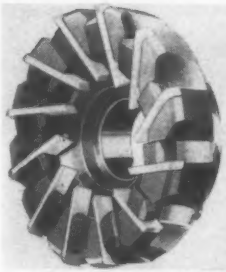
Standard Brush Sizes (inside cut). A total of 58 standard sizes of single and double spiral twisted wire brushes for hand and power operation are now available from Mill-Rose Co. The range of sizes is quite complete—from ⅛" to 1" dia. in single spiral for hand operation and from ¼" to 1" dia. in double spiral for power operation—in 1/16" increments. Abrasion resistant wire for extremely high tensile strength is used throughout. A copy of the Mill-Rose circular will be sent by the manufacturer.
Circle Inform-A-Gram No. A4.

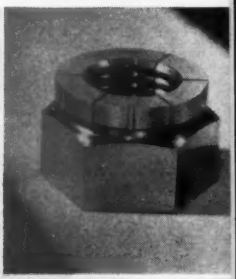
Model T-SRF-¼ Phil-Dump Trailer is a self-dumping unit with a one-half cubic yard capacity. It is designed for three-way use: pulling by hand, lifting and transporting by fork lift truck, and towing singly or in train by industrial tractor. Conveniently sized for handling by one man, this Phil-Dump features a sturdy tongue for manual and tractor handling. Additional details can be obtained by writing PHILLIPS MINE & MILL SUPPLY CO., 2328 Jane St., Pittsburgh 3, Pa.
Circle Inform-A-Gram No. A5.

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

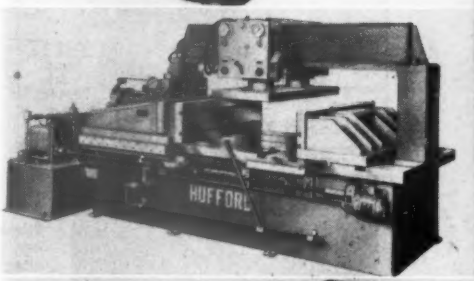
Style KF Kennamill (inside cut) is an improved milling cutter designed primarily for steel production milling runs where adequate horsepower is available, and where intermittent or narrow cuts are encountered. It is also well-suited for heavy cast iron cutting. The KF Kennamill has only four different parts: body, blades, wedges and nuts. Supplement 2 to Catalog 51 of KENNAMETAL INC., 500 Lloyd Ave., Latrobe, Pa.
Circle Inform-A-Gram No. A6.





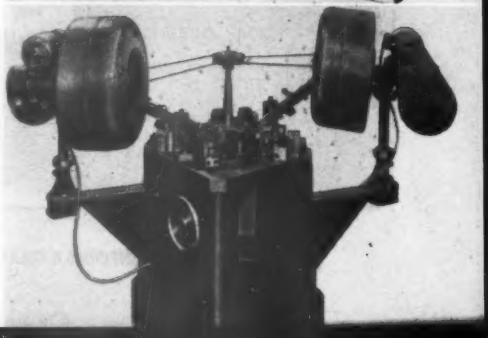
Standard Flexloc Locknuts (outside cut), made by Standard Pressed Steel Co., can be used continuously in temperatures as high as 550° F, the company announced following a series of tests. Because they are made entirely of steel, their locking efficiency is not impaired by relatively high temperatures. These locknuts are slotted so that they exert a grip on a threaded member. STANDARD PRESSED STEEL CO., Box 600, Jenkintown, Pa., will provide sample locknuts and full information.
Circle Inform-A-Gram No. A7.

Electrolimit Radial Internal Clearance Comparator. This special P&W comparator gives fast, accurate measurements of the radial internal clearance in ball bearings. Included among the comparator's parts are a Universal External Electrolimit head with adjustable gaging spindle, a floating gage head mount with calipering finger, a DO-3OU Meter, etc. PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Circle Inform-A-Gram No. A8.

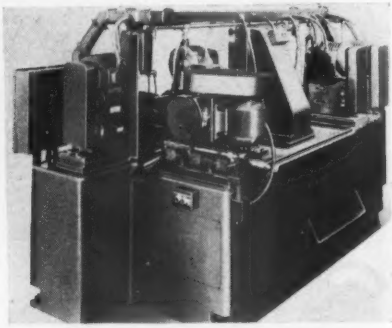


The New Hufford Metal Forming Bulldozer provides vertical die pressure plate clamping cylinders. Sensitive control is provided by a threaded lead-screw type shipper rod along the side of the bed. Although other work capacities and tonnages are available, Model 88 illustrated is rated at 150 tons. Details and specifications are given in literature procurable from the manufacturer. HUFFORD MACHINE WORKS INC., 1700 E. Grand Ave., El Segundo, Calif.
Circle Inform-A-Gram No. A9.

New Thread Rolling Machine. Rolling three times more threads per hour at cost savings of 65% is reported by users of the new Prutton "Rollmaster." Incorporating the efficient "planetary" principle, the "Rollmaster" introduces many unique engineering features for high-speed, long-run thread rolling in a wide variety of metals ranging from non-ferrous to hardened and stainless steels. Write for bulletin to D. H. PRUTTON MACHINERY CO., 5295 W. 130th St., Cleveland, Ohio.
Circle Inform-A-Gram No. A10.

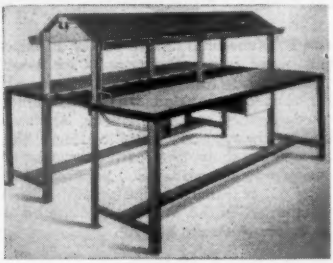


Automatic Bar Transfer Machine provides hydraulic feed of ¾" bar through five in-line stations. At the fifth station, a transfer slide feeds in to hold machined end of bar while a circular saw cuts it to workpiece length. Return of slide carries piece between two drill heads for chamfering. On next in-feed of slide,



finished part is dropped onto a chute, and the next section picked up. MOTCH & MERRYWEATHER CO., 715 Penton Bldg., Cleveland 13.
Circle Inform-A-Gram No. A11.

Inspection Conveyor-Table Unit incorporates two inspection tables with roller conveyor between. The unit can be readily installed in



conveyor line, or work can be brought to the unit by portable trucks with roller-bed top of same height. Tote boxes are then easily moved onto and off of table conveyor. Canopy over conveyor shields fluorescent lights that illuminate table to each side. Canopy also serves as a shelf for rejected parts, drawings, or tools. Each table has electric outlets and tool drawer. SAMUEL OLSEN MFG. CO., INC., 2423-27 Bloomingdale Ave., Chicago 47.
Circle Inform-A-Gram No. A12.

CONVERT YOUR ENGINE LATHES
to
TURRET LATHES

5-Tool Tail Stock Turret

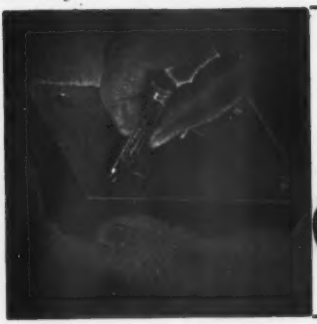
Four sizes up to 24" swing

TODAY
Send for Folder

JEFFERSON MCH. TOOL CO. 672 W. 4th Cincinnati 3, O.

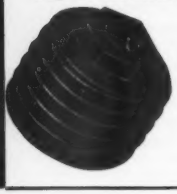
HARDNESS TESTING
has been done with the
SCLEROSCOPE
since 1907

THE SHORE INSTRUMENT & MFG. CO., INC.
9025 Van Wyck Avenue
Jamaica 2, N. Y.



A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring screw holes.

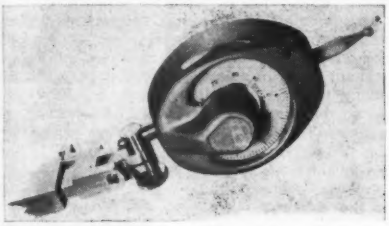


The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in $\frac{1}{16}$" to 1" diameters.

Send for price list.

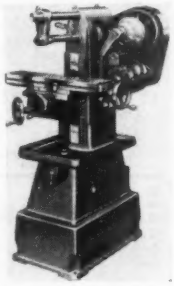
HEIMANN MFG. CO.
Dept. T Urbana, Ohio

Minikator 590 Micro-Indicator permits fine measurement and dimensional transfer in otherwise inaccessible places. Holder allows settings in virtually any position. Two inter-

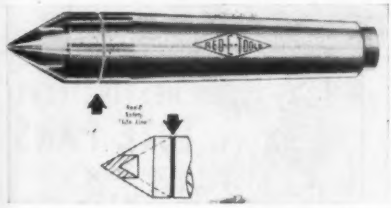


changeable indicator points provide choice of .003" range with dial graduations of .00005", or .006" range with dial graduations of .0001". JOHANSSON GAGE CO., Div'n of Swedish Gage Co., 8900 Alpine Ave., Detroit 4.
Circle Inform-A-Gram No. A13.

Diamond 22M Milling Machine is designed to have the rigidity, precision, and capacity of many larger and more complicated machines. Features longitudinal travel of 14"; maximum vertical travel of 15" (from spindle center to top of table); cross traverse of 15½"; full table working surface of 5¾" x 24". Power feed has automatic kickoff. Attachments and accessories are available for increased machine versatility. DIAMOND MACHINE TOOL CO., 3429 E. Olympic Blvd., Los Angeles 23, Cal.
Circle Inform-A-Gram No. A14.



Red-E Carbide Tipped Centers are now available with a "Safety Life Line" clearly indicating the point to which regrinding is practical.



Permits maximum use of carbide tip, but eliminates danger of using it beyond point where breakage becomes probable. READY TOOL CO., 554 Iranistan Ave., Bridgeport, Conn.
Circle Inform-A-Gram No. A15.

Specify
DURANT
PRESS ROOM EQUIPMENT
INCREASE PRODUCTION
REDUCE COSTS
ROLL FEEDS
Accurate Feeding • Reversible • Easy to install • Highest quality
SCRAP CHOPPER
Fits any Power Press • Electrical Plug Installation • Pays for itself — you get more for your Scrap
STOCK OILER
Save Your Dies • Eliminates hand oiling • Made in variety of sizes
Write Now!
Inquire about this complete Durant line of Low Cost Equipment
Free Catalog Available
DURANT TOOL SUPPLY CO.
155 ORANGE ST., PROVIDENCE 3, R. I.

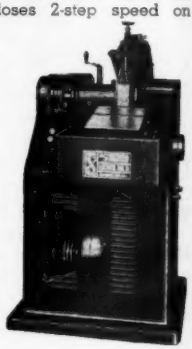
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

Rapid Indexing on Light Milling, drilling, tapping, and similar operations is accomplished with the new air-operated "Web-Aire" rotary index table. The table is mounted on large ball bearings, with large hardened steel stops. All

moving parts are enclosed. The unit is rugged but compact, and is designed for long service, high production, and quality work. A 9" dia. model is carried in stock; other sizes are special. WEB-AIRE PRODUCTS DIV'N, H. G. Weber & Co., Inc., Kiel, Wisc.

Circle Inform-A-Gram No. A16.

Straight Wheel Wet Tool Grinder has been redesigned for greater precision and heavier duty work. It is available in 14, 16, 18 and 20-inch wheel sizes. The 10" x 10" graduated tilting table rest is surfaced with renewable and reversible wear plates. A carefully planned coolant system provides continuous and copious delivery of coolant on wheel and work without spray or splash. All operating parts are easily accessible. Ball bearings are fully protected in large oil reservoir, with visual oil gauge. The base encloses 2-step speed on the V-belt drive with safety interlock to prevent an overspeeding of the grinding wheel. The speed change permits continued grinding efficiency on the reduced diameter of the worn grinding wheel. A start-stop push button station is convenient to the operator's normal working position. Full information is available from STANDARD ELECTRICAL TOOL CO., Mt. Hope & Sixth Sts., Cincinnati 4, Ohio.



Circle Inform-A-Gram No. A17.

Fast, Accurate Measurements
With the AMIC "Quick-Action"
Vernier Caliper

AT NEW LOW PRICES
The perfect tool for machine shop, tool room inspection and Quality Control. A flick of the thumb and you've got your external and internal dimensions. Knife-edged hardened jaws provide exact thread measurements. A depth gage blade gives speedy measurements. AMIC designed and made exclusively for AMIC by an outstanding European manufacturer.
Scientifically engineered, painstakingly machined, packed in a sturdy leatherette case. A tool without rival.
Size 6" #21B, Graduation 1/40", vernier reading .001.
#22B, Graduation 1/40" and full MM, vernier reading .001 and 1/10 MM.
Write for Circular A. Dealers inquiries invited.
AMERICAN MEASURING INSTRUMENTS CORP.
AMIC BUILDING
21-25 44th Ave., Long Island City, N. Y.
TELEPHONE: EXeter 2-0002

DANFORTH DIAMOND POWDER
DIAMOND POWDER
Sieve and Micron Sizes
Closely graded and Purified
Complete Powder Reclaiming Services for
Sludges, Used wheels, Lapping Cotton
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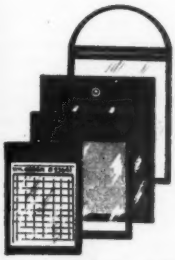
C. W. DANFORTH CO.
(Established 1912)
Box 448, Youngstown, Ohio
DANFORTH DIAMOND POWDER

New NESTING TYPE
TOTE PANS
20" Long x 12" Wide x 6¼" Deep
16 Ga., drag holes, handles both ends.
J. L. LUCAS & SON, INC.
BRIDGEPORT 5, CONN.



Job Ticket Protection from oil, grease, and dust is afforded by durable acetate holders. Differing from conventional types, these holders are edged with heavy 12-gauge Duran binding which will not peel, rot, or fray and which stands up much longer than the conventional leatherette bindings. Holders can be either fully transparent or have durable fibre back. Standard styles and sizes are available for job tickets, shop orders, tote box cards, etc.; or specials can be made to customer's order. PLASTIC SPECIALTY CO., P. O. Box 978 M.O., St. Petersburg 1, Fla.

Circle Inform-A-Gram No. A18.

Precise Torque Control in running nuts on light and fragile parts is now possible with the new Power-Torque Tool, Model MA-25. This air-powered nut runner is useful where excessive torque would cause breakage or distortion of light metal parts, castings, or plastics. The desired torque is easily set, using the built-in standard torque wrench as a gauge. The tool is very accurate and eliminates the need for hand torquing inspections. When the predetermined torque is reached, the tool stops automatically. Complete unit includes remote control box which reduces weight of hand tool

to six pounds. The MA-25 is standard for torque range up to 25 inch-pounds. Other models are available for higher ranges. GARVIN BROS., INC., P. O. Box 536, South Bend 24, Ind.

Circle Inform-A-Gram No. A19.

L&J PRESSES

for Close-Tolerance Production

The reputation of L & J Presses has been built by doing tough jobs—close-tolerance jobs that require sustained accuracy. These rigid, precision-built presses simplify difficult press work. They are built for it! Heavy, deflection resistant frames . . . ruggedly designed slides with extra long gibs . . . and many other features all contribute to their efficient operation.

L & J Presses are made in 12 O.B.I. models—back geared and plain flywheel types—and 8 sizes, 6 to 80 ton capacities.

Write for Literature

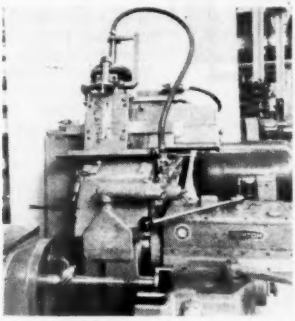
L&J PRESS CORPORATION
1626 STERLING AVENUE
ELKHART, INDIANA

SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

A New Bearing Blue, announced by Dayton Rogers Mfg. Co. is a material that is primarily compounded for spotting, scraping and fitting

of various machine component parts, such as the scraping and fitting of machine tool mating surfaces. It will not dry. Free samples are obtainable upon request on company letterhead to DAYTON ROGERS MFG. CO., 2824 13th Ave. So., Minneapolis 7, Minn.
Circle Inform-A-Gram No. A20.

An Automatic Grinding Wheel Truing Device (wheel guard type) is now available for all Norton cylindrical grinders. The device performs angular, step, straight or combination formed wheel face truing at the touch of a push button, thus eliminating the operating burden normally involved in performing these functions with non-automatic equipment. It permits a close control of the amount of abrasive removed from the wheel, thus reducing wheel cost per piece ground. Write NORTON CO.,



1 New Bond St., Worcester 6, Mass., for additional details.
Circle Inform-A-Gram No. A21.

DON'T TAKE CHANCES!
Specify ACE
DRILL BUSHINGS
ACCURACY — Guaranteed by triple inspection plus light wave control.
AVAILABILITY — Large carefully controlled inventory assures prompt delivery on all ASA standard & many special sizes.
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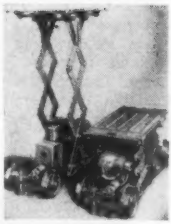
ACE DRILL BUSHING CO., INC.
5407 Fountain Ave., Dept. 1101-9, Los Angeles 29, Calif.

CHICAGO DIES
Complete Line of
PUNCHING and FORMING DIES
for All Sizes and Makes of
PRESS BRAKES
DREIS & KRUMP
MANUFACTURING COMPANY
7428 S. Loomis Blvd., Chicago 36, Ill.

SUPEREAM
REAMERS IN *Decimal* SIZES
From .032 all the way up—Blanks can be ground to your exacting specifications and delivered in approximately 10 days. By purchasing SUPEREAM REAMERS in steps of .001 you SAVE—Time, Labor and Money in the cost of extra machining and lapping. SUPEREAM REAMERS all have ground and polished flutes and are held within .0002 tolerance. REAMERS are also furnished in Right-hand spiral, right-hand cut, as well as Left-hand spiral, right-hand cut.
Write for descriptive literature and prices.
IN EMERGENCY PHONE INDEPENDENCE 3-9180
TWENTIETH CENTURY MANUFACTURING CO.
1720 MONTROSE AVENUE CHICAGO 13, ILLINOIS

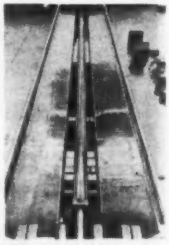


Special Portelvator, for power-lifting of work to any height within specified limits, represents an adaptation of standard components and principles to meet special requirements. Units shown here ride on tracks to carry work from one operation to another. They pick up work at one table height and deliver it at another, lifting work by electrical power. Additional information about this and other applications may be obtained from THE HAMILTON TOOL COMPANY, Hamilton, Ohio. **Circle Inform-A-Gram No. A22.**

Precision Instrument Lathe, with 8½" swing, turns or bores within 0.0001" in six inches, with work held in collet or between centers. With available attachments, this engine lathe is capable of milling, spiral cutting, taper turning, grinding, forming, and other work. Machine is designed for extreme accuracy and

resistance to wear. Catalog 608F is available from the manufacturer, RIVETT LATHE & GRINDER, INC., Brighton 35, Mass. **Circle Inform-A-Gram No. A23.**

Long Stroke Hydraulic Cylinder permits one manufacturer to build automatic honing machines for precision finishing of hydraulic and pneumatic cylinder tubing up to 22' in length and 20" bore. Miller cylinder, built from standard-type cylinder parts and 24' non-sag piston rod, operates the honing carriage back and forth at 120 fpm. It is believed that cylinders of this size and rigidity may now make possible other heretofore impractical or costly operations. Similar cylinders can be provided for air. MILLER MOTOR CO., 2040 N. Hawthorne Ave., Melrose Park, Ill.,



Circle Inform-A-Gram No. A24.

ENGRAVING and MARKING

The Green Engraver

DIAL STENCIL

BARREL DIAL

DIRECTIONAL SIGN

ENGRAVES, ROUTS, PROFILES and MODELS

A real money saver for industry. Proven by the experience of tool and die, electronic machine, radio, electrical and instrument manufacturers.

The Green Engraver zips out precision work on metal, plastics, wood, glass, hard rubber etc. . . . engraves panels, name plates, scales, dials, molds, lenses, instruments, instruction plates, directional signs . . . by simple tracing. *Routing, profiling and three dimensional modeling indicate its versatility.* Electric etching attachment available.

Specify the Green Engraver for the best in low cost performance. Special attachments and engineering service available for production work.

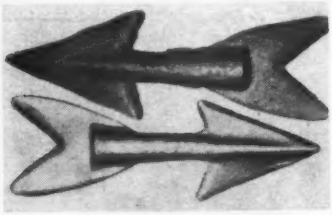
FREE — Fact-packed folder yours upon request.

Green Instrument Co.

380 Putnam Avenue Cambridge, Mass.

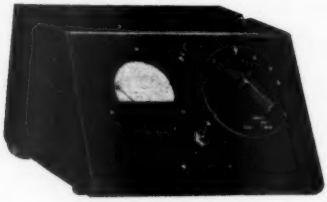
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

A New Compound for Barrel Finishing brass, bronze, copper, gold and silver stampings, castings, machined and drawn parts is offered under the trade name Blue Magic Compound No. 1 Double Strength. It is a highly concentrated paste for use in very small quantities and yields beautifully uniform metallic



colors and finishes in very short time cycles. Timing need no longer be considered a critical factor. Bulletin No. 1 describes advantages and recommended uses of this new compound in descaling, roughing, deburring, and cleaning. A "before and after" view of a bronze casting deburred and finished with this compound is shown. BLUE MAGIC CHEMICAL SPECIALTIES CO., 2135 Margaret St., Philadelphia 24, Pa., will send new Bulletin No. 1.
Circle Inform-A-Gram No. A25.

Stepless Temperature Control, providing wasteless power supply to electric furnaces, ovens, melting pots, and other heating devices, is made possible by the redesigned and improved Temcometer temperature controller. A sensitive thermostatic switch is employed to operate a relay system that carries the load current of the connected equipment. Thus, current can be regulated anywhere between



5% and 100% full "on". Any desired temperature within the capacity of the connected equipment can be selected and held, with automatic compensation for fluctuations in line voltage. Current models feature operating and safety improvements in the electrical circuit, as well as improvements in materials. THERMO ELECTRIC MFG. CO., 474 Huff St., Dubuque, Ia.
Circle Inform-A-Gram No. A26.

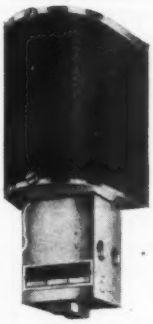
Precision Feeds For All Presses

- Easily installed on any press
- Can't slip. Reverse instantly
- Feed in thousandths
- Maintain original setting. No ratchets or pawls to wear down and affect feed spacing.

Write for descriptive literature TODAY.

ROLL-FEEDS CORPORATION
Pawtucket, Rhode Island
An Electrix Affiliate

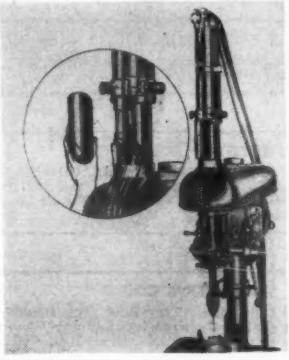
"THE ORIGINAL"
HAUSER
MAUSER PRECISION
VERNIER CALIPER
$14.75 PPD
NEW EXCLUSIVE CAMLOCK AND GIB IMPROVEMENT INSTANTLY FIXES SETTING, PREVENTS SHIFTING, GUARANTEES SQUARENESS OF JAWS.
THE MAUSER TRADEMARK.. IS YOUR PROTECTION.
MONEY BACK GUARANTEE
FOR MEASURING INSIDE, OUTSIDE, AND DEPTH.
3 GRADUATIONS
1/1000" — 1/128"
1/10mm. IN BACK
GEO. SCHERR CO. INC.
200-T LAFAYETTE ST. • N.Y. 12, N.Y.



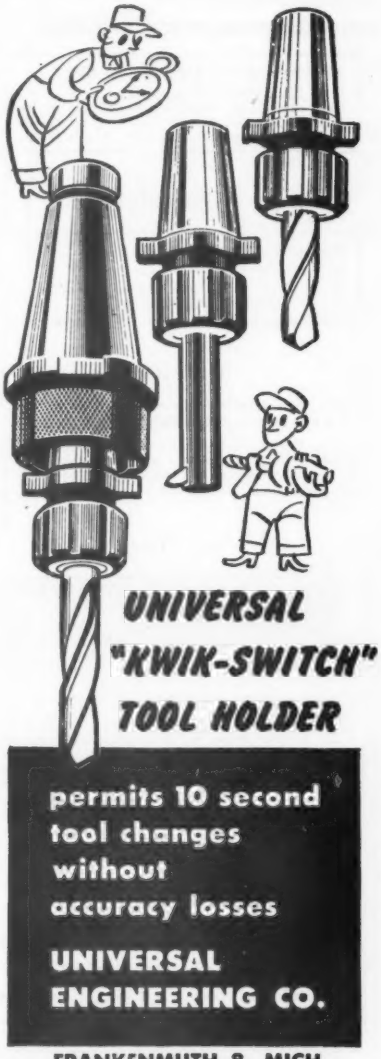
Solenoid Operated 4-Way Pilot Valves similar to the company's earlier 3-way valves have been announced. The new Model 412-250 is designed for use on small double acting cylinders up to 3" dia., and on larger cylinders where excessive speeds are not required. This valve is small, compact, light in weight, and made of non-corrossive materials throughout. The same small solenoid is used as in previous A.V. valves. AUTOMATIC VALVE CO., 37415 Grand River, Farmington, Mich.

Circle Inform-A-Gram No. A27

Automatic Depth Control is assured with the improved "Time Saver" Drill Feed, an automatic power feed unit for conversion of a standard single speed drill press into a high production machine for drilling, reaming, tapping, fly cutting, etc. Production gains up to 400% are claimed by users. The unit operates on shop's regular air pressure, and does not interfere with manual operation of the drill press. Three simple, quick setting control dials govern hole depth, rapid traverse, and variable hydraulic feed. Depth of holes can be accurately held (to within .001"). The new addition of a precision guard over the depth control setting discourages tampering and adds to the reliability of the unit. Full details are available from C. M. Griffin, GENERAL PACIFIC CORPORATION., 1501 E. Washington Blvd., Los Angeles, Cal.



Circle Inform-A-Gram No. A28.



SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

— CONTRACT TOOLING AND PRODUCTION —

Arizona and California

ARIZONA TOOL & DIE COMPANY
P. O. Box 181, Tucson, Arizona — Dial 3-8842. Jig boring and repetition hole spacing work using Boeckeler OPTICAL FOLLOWER. Specialists in small lot radio chassis work.

Illinois

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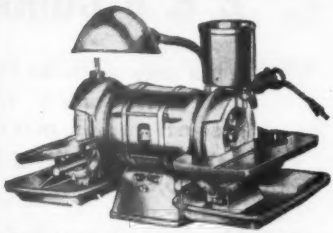

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has balanced armature and wheels, LARGE ball-bearings for precision work. ½ hp, 3400 RPM reversible motor, 6" silicon carbide wheels. Grinds wet or dry. $142.60 complete.

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High Speed Drills ... *EXTRA LONG LENGTH*

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No. By Gage	Length Inches	Our Price Net Each
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11 to 20	5¾	.90
21 to 30	5⅜	.80
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Straight Shank

Size Inches	Length Overall Inches	Length Flute Inches	Price Each Net
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9/64	12	9	1.65
5/32	12	9	1.65
11/64	12	9	1.65
3/16	12	9	1.65
13/64	12	9	1.80
7/32	12	9	1.80
15/64	12	9	1.95
1/4	12	9	1.95
17/64	12	9	2.05
9/32	12	9	2.05
19/64	12	9	$2.25
5/16	12	9	2.25
21/64	12	9	2.50
11/32	12	9	2.50
23/64	12	9	2.75
3/8	12	9	2.75
25/64	12	9	3.05
13/32	12	9	3.05
27/64	12	9	3.30
7/16	12	9	3.30
29/64	12	9	3.60
15/32	12	9	3.60
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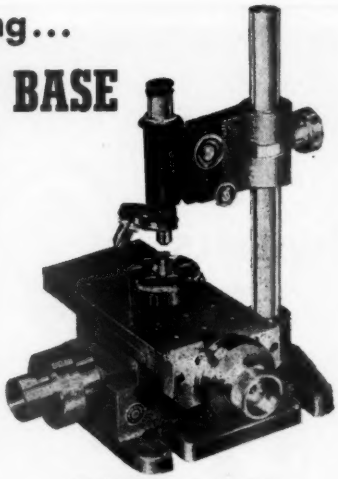
SEE ADVERTISERS INDEX, PAGE 153, FOR KEY NUMBERS

job-tailored to your tooling...

E & G COMPOUND BASE

the only work-table offering 6" lateral and 4" transverse continuous micrometer motion, reading direct to 1/10,000"



a highly versatile tool for precision machine work and inspection, the Compound Base equipped with the microscope of your choice becomes a complete Toolmakers Microscope... mechanically unsurpassed and optically job-tailored to your particular needs!

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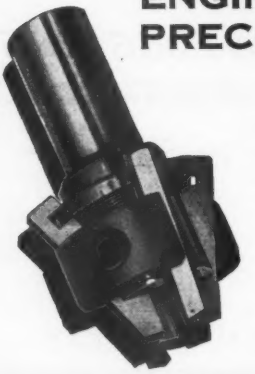
KUTMORE ADJUSTABLE HOLLOW MILLS

ENGINEERED FOR . . . PRECISION PRODUCTION



- ANY COMBINATION OF . . . TURNING . . . TAPERING . . . FACING . . . CHAMFERING . . . TREPANNING IN **ONE PASS.**
- EXCLUSIVE **MICROMETER** ADJUSTMENT FEATURE FOR RAPID SET-UP.
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WRITE FOR CATALOGUE No. 20TD

OUR ENGINEERING DEPARTMENT IS AT YOUR DISPOSAL ON YOUR HOLLOW MILL PROBLEMS

CARL WIRTH & SON, INC. 1625 CLINTON AVE. NO. ROCHESTER 5 N Y

Only THE DUMORE® Automatic Drill Head offers the technique of "resistance drilling" that eliminates drill breakage

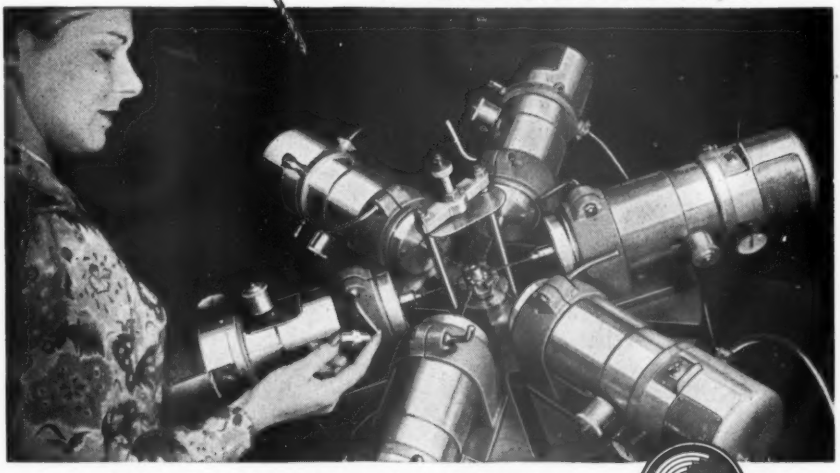
THIS new Dumore tool virtually eliminates drill breakage when used for small-diameter, deep-hole drilling operations.

Utilizing "resistance drilling," the workpiece determines the rate of drill feed and speed. Tool always maintains uniform pressure. No need to rely on operator guesswork. It works closer to the maximum strength of drill.

In proven tests under average conditions, it has set remarkable production records when operating with drill diameters up to 3/32" in steel; up to 1/8" in brass, aluminum, zinc and cast iron; up to 5/32" in plastics and wood.

Get all the advantages of this amazing shop tool. Ask your nearby industrial distributor, or write to The Dumore Company.

This unusual setup is typical of the many ways that the Dumore Automatic Drill Head can save costs on a production problem. Here labor costs on bronze nozzle holders were slashed $75 on the first run of 5273 pieces.



THE DUMORE COMPANY

1313 Seventeenth Street • Racine, Wisconsin

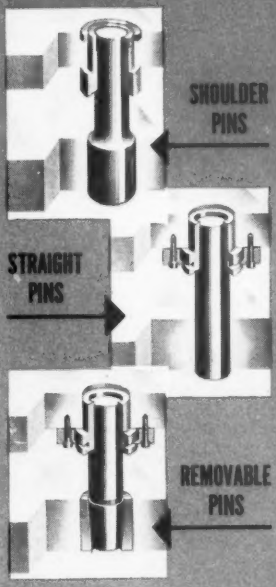
for boosting die output—

and reducing maintenance

Lamina

WATER-HARDENING STEEL

GUIDE PINS



Lamina Guide Pins give exceptional service, too. Made of water-hardening tool steel and precision lapped on the O.D., these quality pins not only wear longer but perform better. They completely eliminate the brinelling and "mushrooming" characteristic of case hardened pins when they are driven into the shoe. Note, too, the improved design of the removable pins which simplifies installation.

DISTRIBUTORS: A few desirable territories are open to qualified distributors. If interested, please write for details.

PATENT PENDING

Lamina Guide Pin Bushings are hardened steel with bronze electroplated on the inside diameter . . . it's the one bushing design that gives you the long wear life of hardened steel with complete freedom from seizing and scoring. Added to the free-running qualities of the bronze bearing surface, a double figure-eight oil groove keeps the pin and bushing properly lubricated at all times.

Lamina Guide Bushings are made in two styles illustrated above and in a number of diameters and lengths. As shown at the left they can be used with straight, shoulder and removable type pins. For longer press runs with fewer shut-downs, specify Lamina Guide Pins and Bushings.

Lamina Dies and Tools, Inc., 14925 W. Eleven Mile Road, Berkley, Michigan.

This new brochure gives complete information and sizes on Lamina Guide Pins and Bushings. It also illustrates many other Lamina dies, tools and die-maker's equipment. Send for your copy, there is no obligation.

Lamina
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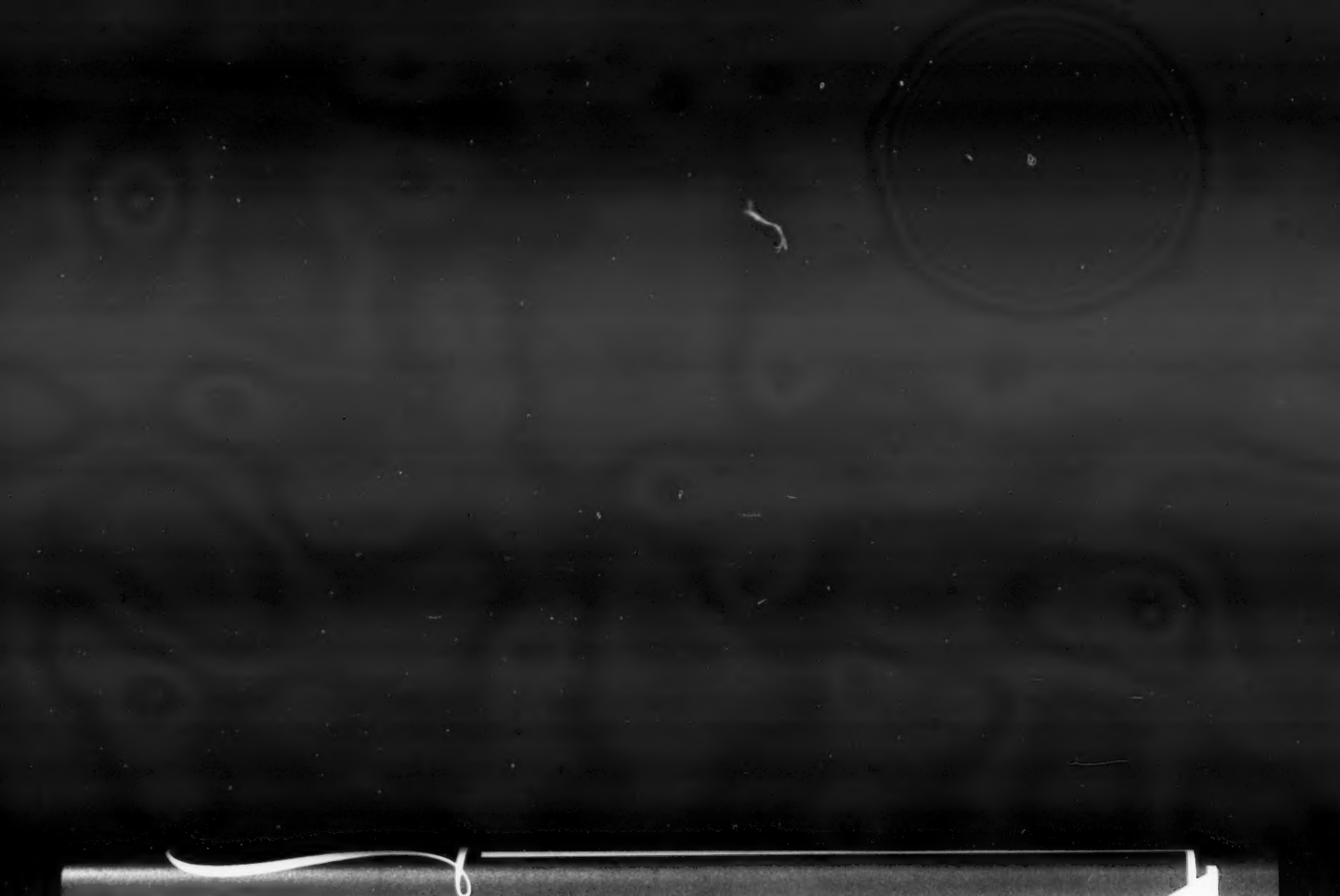
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